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About Authors

● **Carl F. Baker,** *following his graduation from M.I.T. as a mechanical engineer in 1931, spent a year at the Army Air Corps Training Center. He was then transferred to Panama where he put in a year and a quarter of active duty. Since the fall of 1933 he has been associated with Hamilton Standard Propellers, working up to his present position as assistant engineer. In his work he has been primarily concerned with the aerodynamic phases of propeller work.*

● **George W. Brady** *started in the aviation industry twelve years ago when he halted his studies at M.I.T. for six months to work with Glenn L. Martin. He had previously graduated from Yale, and after returning to M.I.T. received his M.S. degree in 1927. He worked for the Chance Vought as project engineer, American Airways as division engineer and the Wanita Engineering Co. as design engineer, before joining Curtiss-Wright's Propeller Division in 1935. He has been chief engineer of the division since last summer. His work in propellers includes structural and detail design work, aerodynamic investigations and development of feathering circuits and constant-speed controls. He was one of the first passengers to fly in a ship equipped with constant-speed feathering propellers.*

● **W. V. Hanley** *(J '33), interrupted his college studies in 1930, after 2½ years of civil engineering at the University of Kansas and Oregon State College, to take a job on the sales staff of Standard Oil of California. The next year he returned to Oregon State for special study on fuels and lubricants, while working part time with the company. After graduating in 1933, with a B.S. degree in mechanical engineering, he was transferred to the S.O. research and development motor-fuel testing laboratory at Richmond, Calif. While there he continued part-time graduate study at the University of California. He has held a number of positions in the laboratory and was placed in charge of the motor-fuel testing laboratory at the first of this year.*

(Continued on page 48)

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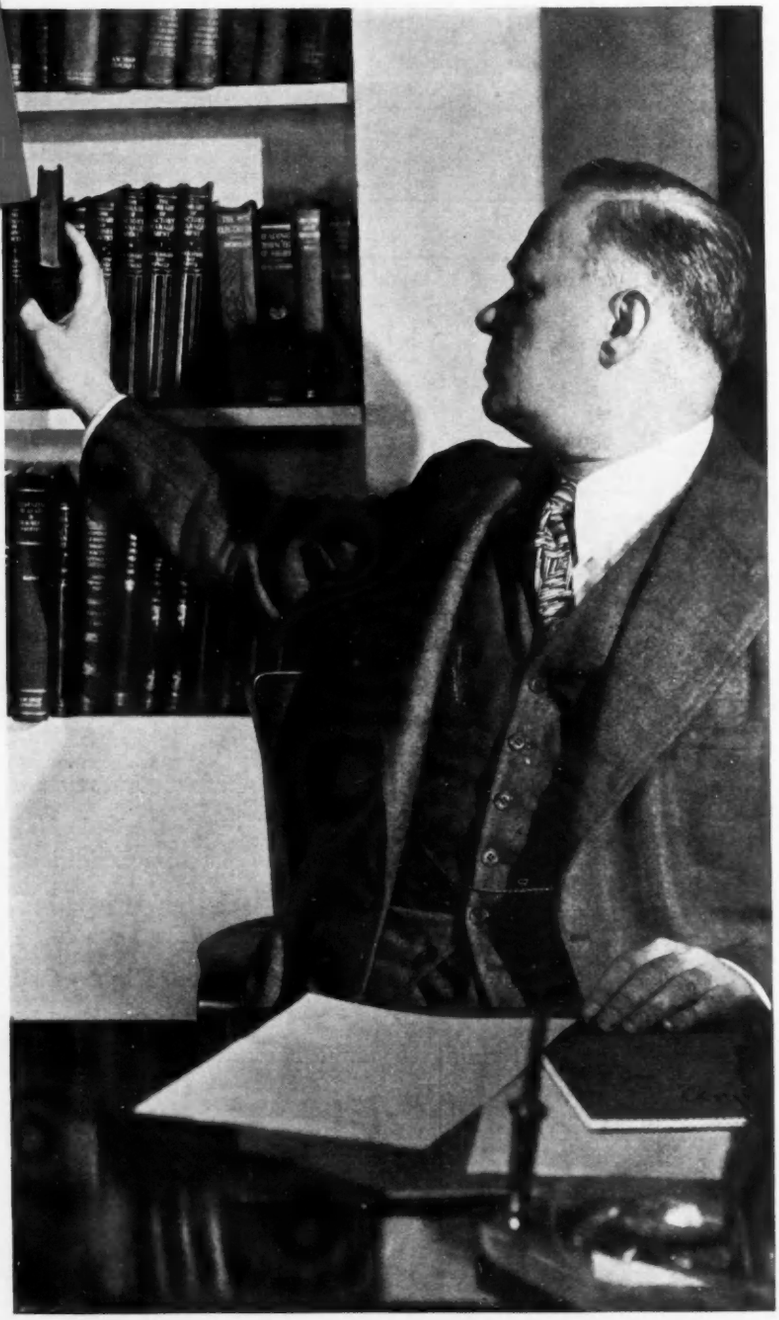

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Steel

War Chief Lauds SAE Help to Army at Broad Summer Meeting

Car and aircraft design debated, fuel test methods argued and Diesel trends pointed. Cleveland wins chassis assembly contest in exciting finish.

SUPREMACY of the poppet valve for airplane engines met its first serious challenge; light load fuel economy difficulties got their best airing in years; details of how the Chevrolet engineering department functions were revealed; and the need for greater standardization of truck equipment in the U. S. Army was emphasized at the Summer Meeting in White Sulphur Springs, West Va., June 12-17.

More than 500 engineers delved into maintenance of automotive electrical equipment, applications of bearing materials, recent Diesel developments, passenger-car ride improvements and lubrication questions as well in 18 sessions and 30 committee meetings which were jammed into six busy days. Detonation research achievements were challenged and defended at a striking symposium. A plea to the Army Air Corps for practical design information on the exhaust turbo supercharger was made at an aircraft engine session. The reasons behind the General Motors 2-cycle Diesel were expounded and discussed. The fallacies of all attempts to improve the standard of living by bringing about scarcity were exposed. Hundreds of other penetrating points emerged from interest-packed sessions throughout the week.

General interest high spots of the meeting included assurance from Assistant Secretary of War Louis Johnson at the opening night banquet that there won't be another Class B truck episode if the United States gets into war again; an expression from Chrysler economist John W. Scoville that "the progress of the industrial age rests on the greater diversification of labor and the use of more elaborate tools and machinery which have saved labor"; and the statement from W. J. Cameron of Ford that "chronologically and geographically, the fewer the machines there have been, the fewer the jobs there have been." Enthusiasm greeted all three guests.

War Secretary is Emphatic

"If war were to come tomorrow," Mr. Johnson said, "I assure you we will not then begin the search, as we did in 1917, for an ideal vehicle. In time of peace, it is well to experiment toward the ideal. In time of war, we must be practical. We will take the best of our types available and immediately go into mass production."

The Army's automotive problems in the way of trucks and cars have not yet anywhere near reached a satisfactory solution, Mr. Johnson said, although he is confident of the ability of

Louis Johnson,
Assistant Secretary of War

Says:

"I AM very happy publicly to acknowledge the help and cooperation of the Society of Automotive Engineers and to extend to you the appreciation of the War Department for your patriotic services toward development of our automotive program for industrial mobilization in time of war and for current procurement in time of peace.

"YOUR guidance and intelligent direction have influenced the development of our tanks, our trucks and our airplanes."

The New Truck Rating Committee Meets

Chairman F. K. Glynn called this new SAE Truck Rating Committee for its first session early in the Summer Meeting week. (*Top row*) Donald Blanchard, C. J. Bock, B. B. Bachman, L. R. Buckendale, F. L. Faulkner, M. C. Horine. (*Sitting*) J. E. Hale, E. M. Schultheis, G. W. Laurie, A. M. Wolf, F. K. Glynn, F. B. Lautzenhiser.

our motor industry to give the Army the right kind of transportation to meet its varied needs.

The chief obstacle to the determination of the War Department to put the Army on wheels, he emphasized, pertains to standardization of equipment. The purchasing system requiring competitive bidding and award of contract to the lowest bidder has resulted in the Army now having 28 different makes and models of passenger cars and 143 different makes and models of trucks. In Mr. Johnson's opinion these constitute "an odd lot of too great a variety." He insists that we must improve "that absurd situation."

Simplification of tank design, Mr. Johnson urged, challenges not only the ingenuity and skill of the engineers of the War Department, but also of those of the automotive industry who, in times of war, will be called upon to produce them in large quantities. The typical modern light tank, he said, consists of 22,000 parts and is covered by 3300 separate engineering drawings.

Extravagant claims made for tank possibilities after the close of the World War have not been realized, Mr. Johnson stated unequivocally. Reports on the value of tanks on the battlefields of Europe and Asia recently are rather contradictory.

The far greater mechanical aptitude of the average American soldier as compared to the Spanish, Japanese or Chinese soldier, however, may easily render such units more effective in American hands. There are long lines of men waiting for appointment to combat car troops and tank companies in the American Army, Mr. Johnson pointed out. American soldiers are enthusiastic about their machines.

"In Europe and Asia," he continued, "the contrary is true. The men are not familiar with the machines. Many of them actually fear the mechanical beasts in their own hands. What would be a minor repair job for an American, may turn out to be a complete collapse for a Spanish, Chinese or Japanese soldier and a cogent reason for abandonment of his machine in the field."

The United States has provided liberal appropriations for automotive vehicles for the Army since 1933, Mr. Johnson said, explaining that the surplus motor equipment from the World War finally became exhausted at that time. Today, he said, our regular Army has about 13,000 motor-vehicles and our National Guard about 8000. Five years ago we averaged one truck, one passenger car and one motorcycle per regiment.

A. T. Colwell was toastmaster at the dinner at which Mr. Johnson spoke. Col. H. W. Alden, chairman of the SAE Ordnance Advisory Committee, welcomed Mr. Johnson and outlined briefly the advances made in U. S. Army methods as regards transport vehicles and policies. A distinguished guest at the speakers' table was Assistant Secretary of Commerce J. Monroe Johnson who responded briefly to Toastmaster Colwell's introduction.

Scoville Ridicules Scarcity Economics

John W. Scoville, Chrysler Corp. economist, talked on Wednesday evening on "Technology and the Volume of Unemployment." Mr. Scoville took the place on the program originally assigned to Dr. James S. Thomas, president, Chrysler Institute of Technology, who was unavoidably absent. Mr. Scoville's talk followed closely the lines of his speech to the May 23 meeting of the Detroit Section which is reported on page 30 of this issue. Col. J. G. Vincent presided at this session.

Cameron on Engineering and Government

Presiding at the Thursday evening session at which Mr. Cameron spoke, Ralph R. Teetor recalled that Henry Ford's application for membership in the SAE was the second to be submitted and that Mr. Ford had been the first vice-president of the Society.

The world is now tool conscious, Mr. Cameron emphasized, pointing out that the tool itself now vies for our admiration with the products it produces. Throughout the ages, he said, tools have marked the rising tide of the advancement of civilization, spiritually as well as materially. There has been little spiritual development, he said, which has not had some physical tool-produced basis as a pedestal upon which to rest. The direct line of development which gave us our present civilization began with the use of metals to make tools. Now, Mr. Cameron believes, "the tool is leading us into a new aristocracy of achievement and social welfare." The tool has been most potent, he pointed out, in freezing discovery of skill into steel and thus conveying that skill from the original inventor to other men.

Mr. Cameron said that the machine has made life more simple – not more complex. As proof of his contention he pointed to the simplicity of cooking, getting from one place to another, heating houses and thousands of other normal operations of everyday life which are far easier today than they were years ago.

He urged that the modern factory, far from enslaving men, actually has removed them from the slavery, drudgery and bad working conditions of the old "craft" days; days which, he said, actually produced relatively few craftsmen as compared to today. More craftsmen are employed today in proportion to the total number of workers than before the advent of the machine, he stated, because more skill is needed now – and still more and more skill will be needed in machine operation as time goes on.

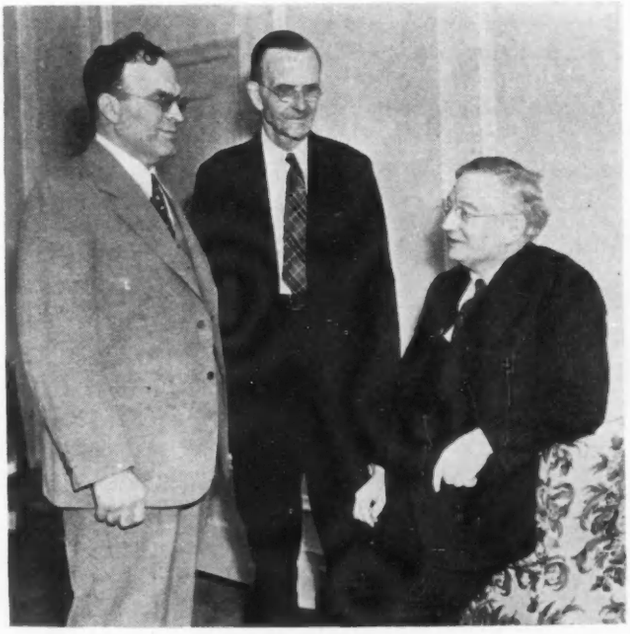
Flaying various New Deal policies, Mr. Cameron urged the need for more thinking of the engineering type in governmental activities, saying that the men who founded our government – Washington, Jefferson, Franklin – were engineers. The reason Canada has had only a slight depression as against our major one at present, Mr. Cameron said, is partly because they aren't trying to jam the kingdom of heaven through parliament before adjournment – and are not faced with the uncertainty as regards governmental policies which afflicts the United States.

Engineering, Mr. Cameron emphasized, will supply what is lacking in our American leadership. "The engineer's doctrine of plenty will defeat the politician's doctrine of scarcity."

Business Session

President C. W. Spicer presided at the Business Session Tuesday evening. The proposed constitutional amendment to extend the office-holding and voting privilege to Service members of the Society was brought before the session and was approved. It will be similarly brought up at the 1939 Annual Meeting before going directly to the Society membership for vote.

Ford Executive Speaks



W. J. Cameron (*right*), Ford Motor Co., chats with President C. W. Spicer and Past-President Ralph R. Teetor before the Thursday evening session at which Mr. Cameron spoke and Mr. Teetor presided.

Passenger Car Testing Session

J. E. Hale, *chairman*

The Passenger Car Activity Committee scored a hit when it introduced a new type of paper – one that centered on the organization plan behind the development of new car models and only incidentally touched upon the product itself. Engineering executives predominated in the audience and took an active part in the informative discussion.

Experimental Procedure of Testing and Organization – *J. M. Crawford and P. A. Collins, Chevrolet Motor Division, General Motors Corp.*

Just what goes on in the development of a new model at Chevrolet, from the time requirements are set until it goes to the dealer, is told by the authors. They explain that the engineering department is divided into three major groups – designing, production and testing, and they outline the jobs in the department from that of the chief engineer down to those of young men without specific titles who are receiving special training which will qualify them for advancement in engineering.

This is made specific as the authors "high-spot" some of the problems of car design and development from a technical as well as a timing point of view, in bringing out the 1937 model, which they say represented the greatest change in any year to date.

They note that every unit of this model, except the front suspension wheel unit, was completely redesigned. Decision to produce it in its final form, they report, was made about the time that its predecessor, the 1936 model, was started in production; adding that this decision could be made only because it was based upon designs of various major units that had been on the drawing boards and on test since early in 1934.

The part played by the various engineering sections and their personnel receives particular attention, as does the cooperation between the sections. The authors also tell how G.M.C. facilities, such as the General Motors Research Division, and the proving grounds at Milford, Mich., and Phoenix, Ariz., tie up with this development work.

Discussion

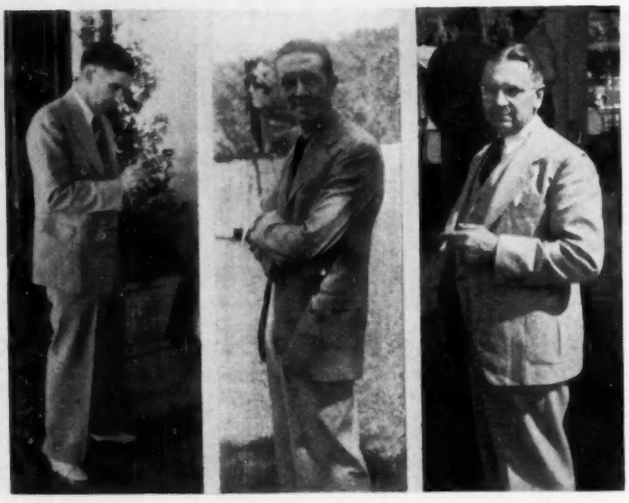
Engineering department costs at Chevrolet vary from 75 cents to over $3 per car, depending upon volume of production, Mr. Crawford stated in answer to a question by Frank C. Mock of Bendix. He added that the engineering staff is of quite constant size, around 550, and that it is little affected by business conditions. He noted that much of the experimental and development work on new devices is absorbed by the corporation as a whole, and said that car manufacturers' development and engineering costs are considerably less because of extensive work along these lines done by parts and accessory manufacturers.

Asked by B. B. Bachman, Autocar, how experimental department men making comparative tests are kept from being "Chevrolet minded," Mr. Crawford replied that this is not too much of a problem because the test engineer likes nothing better than to find something "on the designer." What the public has to say is the final check, he added.

Mr. Crawford reported that field reports carry most weight on a test, those from the proving ground next and that dynamometer reports get least attention. He emphasized, however, that dynamometer work is decidedly worth while, particularly as a measuring stick to compare one model with another. At that point it was suggested by W. J. Davidson of General Motors that engineers run two kinds of dynamometer tests, one to prove why they are right and the other to find the facts.

The importance of the public's reaction was shown by Mr. Crawford when he noted that the service contact man is directly under the chief engineer and that reports from the corporation's customer research division go directly to the chief engineer.

Seen About the Meeting



Prof. R. A. Moyer A. L. Clayden E. M. Schultheis

Passenger Car Chassis Session

F. E. Watts, *chairman*

Vibrations, jolts and other elements contributing to an uncomfortable automobile ride were attacked from many different angles by authors whose papers were read at the chassis session and by those contributing to the discussion.

Crankshaft Dampening and Motor Mountings – *Thomas H. Peirce, H. A. King Co.*

It is Mr. Peirce's belief that "we engineers as critics are entirely too critical with regard to low-end smoothness below 10 m.p.h." At that low speed, he says, few drivers actually expect smoothness and the average operator will shift from high to second instead of accelerating in high gear. He states, however, that the public is "vibration conscious" and that the smoothness of an automobile is often the deciding factor in the purchase of a car.

He points out that although reciprocating parts of engines are selected and balanced within close limits in order to obtain smoothness, there still remains the possibility of further reducing the effects of vibration in powerplants by the use of torsional vibration dampeners and motor mountings.

Mr. Peirce describes torsional vibration tests made on both passenger-car and commercial engines and graphically illustrates results obtained with the use of the rubber-type vibration dampener. He covers the procedure used in working out dampener designs, the fabrication of sample dampeners, the values used in determining the size of the dampener used for design purposes, the deflection check valves needed in order to approximate dampener frequency, characteristics of the bonded-rubber dampener and results of comparative torsional vibration tests on cast-iron and forged crankshafts.

His discussion of motor mountings treats torque reaction, clutch chatter, stability of powerplant, rigidity of supporting members, gearshift lever whip, low-speed smoothness and the effects of powerplant vibration with conventional mountings.

Tire Design Factors Influencing Control of Vibration in Automobiles – *E. S. Ewart, U. S. Rubber Products, Inc.*

Larger, lower inflation tires and softer suspensions, properly coordinated, can do much to improve riding comfort of future cars, maintains Mr. Ewart. He emphasizes the necessity of cooperation between car engineers and tire engineers in solving such vibration problems as shimmy, tramp and those caused by road surfaces and tread patterns.

Adoption of low-pressure balloon tires in 1924, he says, focused attention of engineers on tire vibrations, which resulted in control of balance and runout. In 1934, he adds, larger section balloon tires requiring lower pressure were adopted because of the softer ride and marked reduction of vibration they provided.

He reviews how tire sizing is done and points out that when the tire engineer is called in to discuss the tire sizing of today's car he finds that, except among the style and quality leaders, the tire with the smaller section, higher inflation and higher spring rate is still being selected because of the lower initial cost to the car manufacturer. It is true, he says, that the tire may be adequately sized for the load of the car and the inflation used, but this practice does not include the advantages of improved tire spring rates to reduce vibration.

He describes one type of comfort recorder and reports results of studies of tires when running over bumps on a test wheel with varying tire sizes, inflations and velocities.

Harshness in the Automobile – *H. A. Hicks and G. H. Parker, Chrysler Corp.*

Harshness in the ride of an automobile is felt as a disagreeable tremor or shock, sudden in nature as distinguished from the opposite sensation which could be described as slow, soft and mellow, the authors state. They add that it is in the nature of a tremor having a frequency in the higher shake range and approaching the threshold of audibility.

This paper is limited to analysis of the harsh vibrations which emanate from tire contact with the road, excluding the effects of the tires themselves.

The authors describe methods of measuring harshness both in the laboratory and on the road, discuss car harshness in its relation to rigidity and touch upon its relation to suspension.

It is pointed out that there has been a decided trend toward more rigid construction and that, in general, harshness has increased as rigidity has been obtained. It is also noted that fore and aft shocks are more pronounced with independent suspension than when leaf springs are used.

Two methods of reducing harshness are explained, although the authors state that there are probably many ways of solving the problem.

Discussion

The use of shear stressed rubber to obtain range smoothness and of rubber in shear for torque-resistant mountings in the mounting of an automobile engine was advocated by Thomas Lord, Lord Manufacturing Co., when Chairman Watts called upon him to present his prepared discussion of Mr. Peirce's paper. He also noted that it is generally agreed that for large deflections, rubber used in shear is a much more satisfactory medium than rubber used in compression.

Mr. Lord believes that with adequate stability control a great deal of progress can be made by using still softer mountings which will further absorb vibration. In his mention of stability he says that he refers to that necessary for both roadability and for control of fore and aft movement.

Mr. Peirce stated that he agrees with Mr. Lord that it is best to have shear rubber mountings at the rear, but he noted that by combining shear rubber mountings with compressed rubber mountings the same results can be obtained as with shear rubber alone.

The law of diminishing returns was referred to by R. D. Evans, Goodyear Tire & Rubber Co., in his prepared discussion of Mr. Ewart's paper, read by J. C. Tuttle of the same company. He called attention to the fact that tire pressures have been reduced from 70 or 80 lb. to the present range of 20 to 30 lb. in a period of less than 20 years. He stated also that the time already has arrived in the art of tire design when careful scrutiny must be made to find out whether a more economical way to a softer, smoother ride does not exist other than the long-used and much-abused one of lower and lower tire pressure.

Mr. Evans also noted that in the modern vehicle the tires are undoubtedly subject to a faster rate of wear, relative to the useful life of a car as a whole, than any other major component or accessory. He named the following as contributing to a type of tire wear which is not only unnecessarily and uneconomically rapid, but is also annoyingly conducive to reactive car vibrations: carelessness in application of tires and in observation of pressure recommendations; lack of attention to brake adjustments and condition of drums; short-cut designs for, and hasty, inadequate methods of checking steering geometry and alignment conditions.

Adding a comment of his own, Mr. Tuttle called attention

to the fact that on a large number of cars front tires wear irregularly, showing several flat spots irregularly spaced and obviously not caused by tread design or tire construction. These tires, he said, will produce vibrations, but we must also be concerned with the mileage. He explained that faulty steering and out-of-round drums are responsible for most of this wear, and declared that we should urge car engineers to consider means of improvement in both, particularly steering.

R. N. Janeway of Chrysler complimented Mr. Hicks and Mr. Parker upon stimulating thought along new lines, particularly upon fore-and-aft disturbances, and for stressing the fact that the frame has a small part in fore-and-aft rigidity. Mr. Janeway declared that engineers must be more "human-reaction" conscious – because in final analysis the passenger's reaction is the most important.

Before the session was adjourned B. J. Lemon, U. S. Rubber Products, Inc., called attention to the exhibit of riding comfort instruments in the auditorium arranged by Roy W. Brown of Firestone, chairman of the SAE Riding Comfort Research Committee.

Members Grouped for Informal Discussion and Play

1. W. E. Brown, T. P. Chase
2. G. H. Freyermuth, L. C. Lichty, E. W. Upham
3. Frank Jardine, V. C. Young
4. K. D. Smith, A. M. Wolf
5. Val J. Roper, W. F. Little, G. W. Keown
6. A. G. Marshall, J. C. Geniesse, A. F. Underwood

Passenger Car Engine Session

F. C. Mock, *chairman*

"For the past 20 years there have been papers presented on full-load economy, but to the best of my knowledge this is the first group of papers to be devoted to part-load economy," Chairman Mock declared as he opened the Passenger Car Engine Session.

Some Factors Controlling Part Load Economy – *Hector Rabezzana, AC Spark Plug Division, General Motors Corp.*

Automobile engines, Mr. Rabezzana declares, have reached a point where it is very difficult, by a single improvement, to render any decidedly better performance; adding that in his opinion any further worthwhile improvements in engine economy on a conventional engine will be made only by several well-directed moves concerning small details.

He points out that improvements in part load economy can be obtained by using a homogeneous mixture and efficient ignition.

Multi-cylinder engines are the ones most affected by low economy at light loads, he maintains, and lists the following as the main disturbing factors inherent to the majority of them: non-uniform mixture distribution between cylinders; low mixture speed in the manifold at light loads; poor turbulence in the cylinder head; stratification of the mixture; dilution of the mixture due to the valve timing overlapping the high exhaust back pressure; poor scavenging around the spark-plug gap position; improper mixture at the spark-plug gap.

Observed Effects of Distribution, Engine Friction and Compression Ratio – *Floyd F. Kishline, Willys-Overland Motors, Inc.*

Distribution, says Mr. Kishline, embraces more than just rich or lean mixtures in the various cylinders; it also has to do with distribution of fuel in the compressed charge in each cylinder before firing.

On the subject of friction the author points out that the term usually embraces the total power required to drive an engine when not firing, and that, unfortunately, this is not the true measure of the loss from this source encountered in actual operation. He explains the causes of variations in friction between an engine not firing and one in operation, and how they contribute to errors in arriving at indicated horsepower.

He emphasizes that the portion of observed friction horsepower represented by pumping and pneumatic losses is important and that it constitutes a large part of the parasite loss. Mr. Kishline likewise notes that pumping losses are proportional to engine displacement where other conditions remain constant. Therefore, he says, it seems clear that if an engine is supercharged its output goes up while the pumping losses remain constant.

In Mr. Kishline's belief higher compression ratios offer the most fertile field for improvement of economy.

Winners of Ladies' Bridge at Kate's Mountain House Session

Top row: **Mrs. H. H. Henchel, Mrs. W. G. Ainsley, Mrs. F. M. Young, Mrs. R. L. Hicks.** ***Sitting:*** **Mrs. H. O. Johnson, Mrs. N. N. Tilley, Mrs. A. L. Beall, Mrs. C. M. Larson, Mrs. P. H. Oberreutter, Mrs. H. E. Figgie.**

Analysis of Throttled Engine Operation – *L. C. Lichty, Yale University*

Theoretical analysis of throttled engine operation, says Professor Lichty, shows a very appreciable increase in clearance gas dilution and suction temperatures. The rise in suction and compression temperatures with dilution, he explains, appears to more than offset the tendency of dilution to increase the efficiency. The increase in pumping loss percentage causes the indicated efficiency to decrease rapidly as the throttle approaches the idling position, he continues.

Professor Lichty gives proof for the loss of efficiency due to burning fuel before or after dead center. The known effect of dilution on time of combustion makes good distribution of fuel and air, in and between cylinders, as well as optimum spark advance a necessity for part-throttle economy, he explains. Throttling an engine, he says, indicates the possibility of better fuel atomization and vaporization. He added that mixture distribution data show conflicting results at different speeds and indicate the complexity of this problem.

The author also gives proof for the loss of efficiency for heat transfer from the gases to the cylinder walls. He notes that heat-transfer computations based upon theoretical temperatures result in relatively correct values at or near wide-open throttle conditions, and absurdly high values at closed or nearly closed throttle position. Heat transfer at nearly closed throttle results in appreciably lower temperatures and much more dilution than the analysis neglecting heat transfer indicates. Consequently, he states, theoretical analysis of part-throttle operation should include heat transfer, since a much greater percentage of the energy supplied leaves the process as heat transfer under this condition than under wide-open throttle conditions.

Professor Lichty also presents a method for determining suction temperatures for the suction process beginning with the liquid fuel and air before entering the carburetor.

Tank Mileage – *W. E. Zierer and J. B. Macauley, Jr., Chrysler Corp.*

Sympathizing with the engineer who finds that the high efficiency designed into his engine fails to produce the anticipated increase in average miles per gallon obtained under normal driving conditions, the authors touch upon some of the factors, many of them out of the engine designer's control, which may completely mask the expected improvement.

In doing this they start with an engine of known specific consumption and show the effect of air resistance, chassis friction, gear ratio and car weight on constant-speed road economy; comparing calculated values with actual test values available.

Also discussed are such factors as climatic variations, traffic operation, cross-country driving and the individual driver, which have a definite effect upon economy, but over which the designer has little or no control. The effect of these factors is illustrated by the spread in tank mileage shown by a number of cars of similar model in fleet operation.

Discussion

Vincent C. Young, Wilcox-Rich Division of Eaton Manufacturing Co., noted that the authors made little reference to mixture temperatures and stated "I believe that this is of utmost importance and should be included in any distribution study." He called attention to Professor Lichty's statement that the relative time required for the mixture to flow through the intake manifold depends on manifold pressure, mixture temperature, and volumetric efficiency, and that the time required for the flow through the manifold is greater for throttled than wide-open conditions. Still, he said, if the heat applied is not of sufficient quantity then even this increase in time is insufficient to improve the vaporization point where equal distribution is obtained.

Mr. Young reported actual tests indicating variations as high as 25 per cent air-fuel ratio between cylinders can be reduced to less than 3 per cent variation with an increase of only 20 deg. fahr. mixture temperature at a corresponding loss in b.m.e.p. of less than 2 per cent.

He believes that an improvement can be obtained by careful study of valve timing in conjunction with manifolding, and, he reported, studies are being made along these lines in connection with automatic lash adjusters as mentioned in Mr. Rabezzana's paper. Mr. Young suggests that more study be given to idle, or just-off-idle conditions, although he stated that this effect is only under certain types of operation.

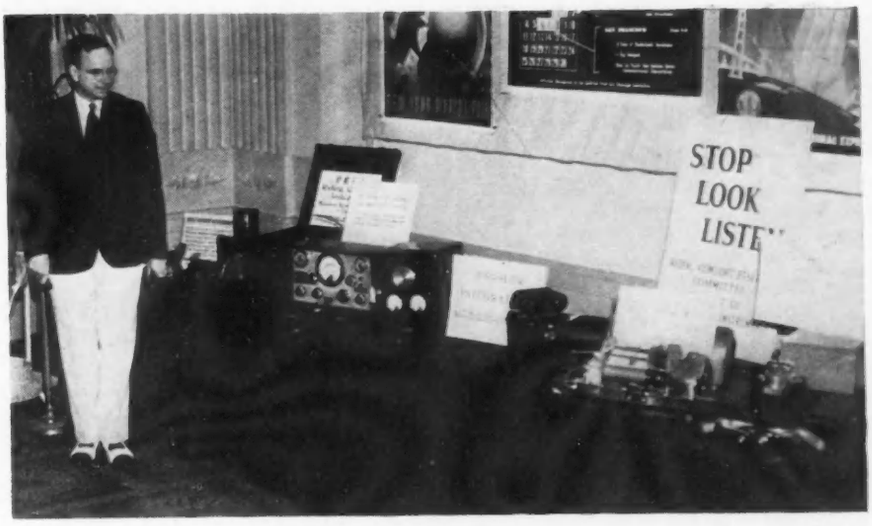
In entering the discussion R. N. Janeway of Chrysler stated that this type of session is one in which the SAE reaches its ultimate performance. He complimented Professor Lichty on

Riding Comfort Instruments Exhibit Attracts

Through its Riding Comfort Research Committee, the SAE for many years has encouraged development of suitable instruments to measure accurately various factors affecting riding comfort.

The great strides which have been made in the work of developing instruments having to do largely with measuring car vibrations resulting in passenger fatigue were interestingly dramatized in this exhibit by the Riding Comfort Research Committee. Included are integrating accelerometers, vibration counting instruments, electric recording instruments, curve drawing recording accelerometers, recording vibrographs, averaging indicating velocity meters and other instruments.

Roy W. Brown, chairman of the Riding Comfort Research Committee (*at left*) was responsible for development of this striking exhibit, detailed arrangements for which were handled by a subcommittee of which B. J. Lemon was chairman.



the soundness of his approach to the problem of part-throttle operation, and expressed his belief that Professor Lichty's work should be carried on to include a study of mixture ratio. He noted that the potential thermodynamic efficiency tends to improve with leanness of mixture and that reduction of pump loss might be reduced by extending the operating range of mixture ratio beyond the present practice.

Almon L. Beall, Wright Aeronautical Corp., stated that he was sorry that Professor Lichty's work was not done over a range of mixture ratios and hoped that it would be continued in this direction.

Professor Lay noted that every bit of heat built up in a car costs the owner money in gasoline purchased to supply the energy, and argued that friction losses, no matter where they occur, must be overcome.

In summation Professor Lichty agreed that his paper is but a beginning and that there is much more to be done on the subject. He brought attention to the fact that although lean mixtures are theoretically more efficient, it must be remembered that leaning the mixture causes slower combustion, and reduces the efficiency. This, he said, must be taken into consideration.

Mr. Kishline added to his paper in discussion by reporting the installation of a 1935 motor in a 1928 car. The original motor, he said, was of 322 cu. in. displacement, weighed 1100 lb., and rendered 11.5 miles per gal. in operation. The new engine had a displacement of 264 cu. in., weighed 740 lb., and increased performance to better than 15 miles per gal. That, he said, shows how far we have come in the past 10 years.

Truck, Bus and Railcar Session

H. E. Simi, *chairman*

Accurately colored slides perfectly illustrating many of the author's most pertinent points were an unexpected addition to the T. B. & R. Session Monday evening.

Automotive Bearing Materials and Their Application – *Arthur F. Underwood, Research Laboratories Division, General Motors Corp.*

Development of higher octane fuels, which will allow more power output through higher compression ratios with a given size engine, and the increasing use of Diesel engines for trucks and buses, will bring about a need for radically superior bearing materials, Mr. Underwood predicts in the early part of this paper.

Stating that a bearing material does not always require excellence in all characteristics, he lists the properties which make a good bearing alloy as: fatigue strength; ability to resist seizure to the steel shaft during periods when there is metal-to-metal contact; good bonding characteristics; mechanical compressive strength; conformability; embeddability, and corrosion resistance.

After describing tests for each characteristic, he treats the functional differences of the present available bearing materials, some of which are still in the final period of development.

Mr. Underwood shows that the numerous commercially available bearing materials have individual characteristics which must be considered in conjunction with the use to which each one is put. Bearings are like people, he says, in that they must be selected for the job they are to perform.

The author believes that future bearing materials will give greater fatigue life than the popular white metals and will have their anti-score characteristics. They will be non-corrosive and less susceptible to dirt and deflections, he adds.

Bearings, he predicts, will be designed for higher load factors as these materials are developed. This means narrower bearings, he says, and states that even now one design of connecting rod has reached the limiting width necessary for the bolt.

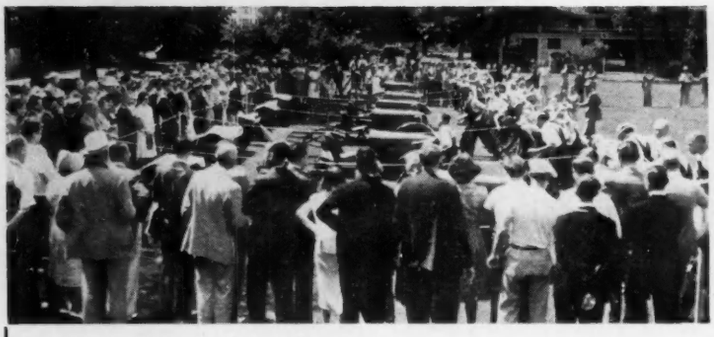
Discussion

In opening the discussion period Chairman Simi called upon M. C. Horine of Mack to present his prepared discussion. Mr. Horine noted that the author "gives us little else to look to for relief other than continued improvement in bearing metals – besides control of lubricant acidity and oil temperature, improved bearing cooling and rigidity and reduction of friction between the bearing and its journal." It is Mr. Horine's belief that the best solution lies in the development of a "magic" alloy of moderate cost capable of resisting higher PV despite the mechanical shortcomings of engines, corrosive oil and the prevalence of extremes of temperature. He does not believe that even a "magic" lubricant would be so satisfactory a solution because, while the manufacturer can control the material used in his bearings, no power on earth can dictate the kind of oil which will be used in his engines.

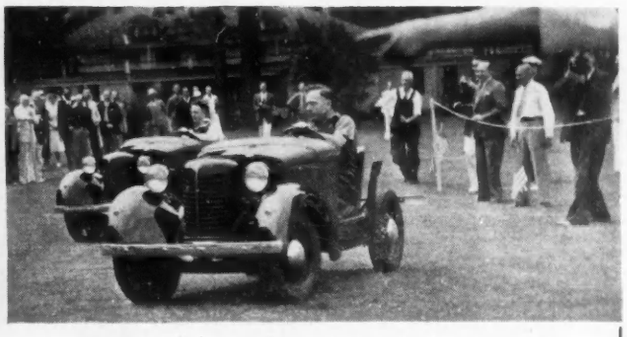
In case that neither a "magic" alloy nor a "magic" oil should be immediately forthcoming, Mr. Horine suggests further study of other factors which would tend to reduce bearing failures. Among these he mentioned heat dissipation; more thoroughgoing counterbalancing of shafts and more meticulous balancing of rods and other reciprocating parts; stiffer boxes and webs for the bearings; fits and tolerances and perfection of surface on the bearings themselves; closer uniformity of oil temperatures to keep the viscosity of the oil more uniform; and better combustion control.

Gavin W. Laurie, Atlantic Refining Co., voiced full agree-

Chassis-Assembly Honors to Cleveland in Photo-Finish Contest



The Start – all teams got away fast



The Finish – the winner is in the background

CLEVELAND won the exciting chassis-assembly contest Wednesday afternoon when its car completed the 100-yard circle and came back to its assembly bay a split second ahead of Indiana's entry, assembly of which actually had been completed first.

Six Sections teams worked fast and furiously – some fast and some furiously – on the six Bantam chassis brought to White Sulphur by W. E. England, chief engineer of Bantam, through the courtesy of the American Bantam Car Co. The result was an hour of thrills, fun and excitement for participants and onlookers.

J. G. Vincent was official starter and J. S. Tawresey, official timer. The time of the winning Cleveland team was 23.12 min. Second was Indiana in 23.22 min. Third, Chicago, 28.10 min. Fourth, Detroit, 36.45 min. Fifth, Philadelphia, 43.35 min. Sixth, Metropolitan, 50.50 min.

There were six inspectors, one in each booth. They were Tore Franzen, K. L. Herrmann, R. L. Morrison, A. J. Schamehorn, E. M. Schultheis, and A. M. Wolf.

The members of the participating teams were: *Cleveland* – T. S. Kemble, chief engineer, F. S. Baster, R. W. Brown, C. A. Dively, A. A. Skinner, L. E. Wells. *Indiana* – R. M. Critchfield, chief engineer, Clarence Bruce, R. L. Hicks, C. A. Michel, O. V. Montieth, Macy O. Teetor. *Chicago* – J. O. Eisinger, chief engineer, E. R. Barnard, M. B. Chittick, J. T. Greenlee, H. L. Moir, T. H. Risk. *Detroit* – E. H. Smith, chief engineer, M. J. Brennan, G. C. Brown, Joseph Geschelin, F. F. Kishline, W. B. Stout. *Philadelphia* – L. M. DeTurk, chief engineer, B. B. Bachman, Herbert Hosking, C. H. Van Hartesveldt, A. J. Scaife, G. W. Laurie. *Metropolitan* – M. C. Horine, chief engineer, H. F. Blanchard, F. K. Glynn, Neil MacCoull, S. G. Tilden, A. T. VonSchmid.

ment with the author's statement that bearing alloys must be selected for the jobs they are to perform. In reading his written discussion Mr. Laurie stated, "The truck manufacturer undoubtedly chooses a bearing material that he considers satisfactory for the particular design of engine, and it will in general prove satisfactory in service. However, in many cases, due to the type of truck operation, it becomes necessary for the operator to make his own tests with different bearing alloys, and he eventually finds one that gives improved service for this particular type of operation. This is just another way of saying that we have yet to find a bearing alloy that meets all operating conditions."

Mr. Laurie then gave a detailed account of how his company selected the proper bearing alloy to replace that provided by the manufacturer for a type of service wherein the original bearing proved unsatisfactory.

Before concluding his discussion, Mr. Laurie declared that the engine r.p.m. must be included in any discussion of bearings, noting that the rod bearing pressures, resulting from inertia forces of the reciprocating parts, increases rapidly with speed, so that at higher engine speeds this factor is of primary importance. He added that considerable progress has been made in the past few years in lowering bearing pressures by the reduction of weight of reciprocating parts, permitting the use of higher engine speed, such as is found in present-day truck engines.

Almon L. Beall, Wright Aeronautical Corp., asked the author about an illustration of corrosion of a copper-lead bearing which he pictured. He said that he had never seen a copper-lead bearing corroded in service and wanted to know if Mr. Underwood had evidence that the structure was uniform throughout and that the corrosion was not due to gas pockets or lead pipes in that only certain parts of the bearing surface showed corrosion.

Mr. Underwood replied that the bearing had been microscopically studied but had not been inspected by X-ray.

At this time Mr. Underwood briefly referred to aluminum bearings, stating that he had never seen a usable aluminum bearing, as aluminum is worse than copper-lead or silver in scoring. He noted that they are used on the other side of the water because there is no tin to speak of in any major country of the world and European countries, war-scared, are seeking to be self-sufficient.

Dr. Ulric B. Bray, Union Oil Co. of Calif., entered the discussion, remarking that solvent refined oils are often wrongly blamed as the cause of corrosion. He noted that solvent refined oils are less violent in their action on bearings than many oils not solvent refined. He also warned that care should be taken in selection of inhibitors, some of which he said, are being marketed despite the fact that they are "trash."

He also suggested that it would be better for the car manufacturer to spend perhaps ten or fifteen cents more per bearing to make bearings non-corrosive than to make the vehicle owner pay from five to ten cents more per gallon for oil to prevent corrosion. (*Continued on page* 33)

1. Indiana in action
2. Met's chief engineer, *left*, and chairman, *right*
3. Cleveland smiles a winner's smile (*at left*, official starter J. G. Vincent)
4. W. E. England – the man who brought the Bantams
5. Philadelphia confers
6. Detroit at work
7. The inspectors – by their hats ye shall know them
8. Chicago gets ready

All Teams Enjoyed the Fun – Win, Lose or Draw

Automobile Seat Cushions and Riding Comfort

Report from Riding Comfort Research Committee

By Clark A. Tea
The Chrysler Corp.

THE design of automobile seat cushions is becoming increasingly important in the attainment of good overall riding comfort of the automobile and, except for some specialized research[1], aided by developments of new cushion materials, this problem has not been given the attention that it deserves. In fact it usually is neglected as an engineering item, seats being designed mainly to fit conditions imposed by the body structure and to enhance eye appeal.

It is only since the chassis suspension has been improved vastly that the importance of seat cushions on ride has been realized fully. There is now a growing tendency on the part of engineers to study the mechanics of correct seating and to discover the variables that affect riding comfort in an effort to establish certain basic data which will lead to something more tangible than mere arbitrary procedures.

This paper is prepared from numerous laboratory and road-test data obtained over a period of years on various kinds of cushions, and is intended as a summary of pertinent facts, rather than as a comprehensive treatise on automobile seating. It is hoped that it will serve to emphasize the need of more profound research on this subject.

The function of an automobile seat is to provide comfortable riding over long or short distances with a minimum of fatigue. Such a statement closely analyzed implies two requirements: first, that the seat cushions support the passenger in a natural posture; and, second, that they provide for the absorption of vibration energy with as little disturbance as possible to the distribution of body support and to the passenger as a whole.

It is conceivable then that a solid material if shaped to fit anatomically a particular person with properly graduated contact pressure, would do as much for "sitting" comfort as any compressible self-conforming material. As an example of this principle we have the so-called form-fitting chairs, which are, of course, more comfortable than the plain ones over a long period of time. In designing cushion springs it is logical to investigate first the conforming ability of the resilient parts for determination of proper contact pressures, which is number one design requirement. Actual deflection at one point or another means very little in this attainment but, as we shall see further on, in most cushion springs the deflection at the center of pressure is related mathematically to frequency and to the absorption of impact forces. A direct concentrated load test on a cushion for measuring deflection has no definite relation to comfort and, for that reason, must be used with caution.

From test data the mean unit pressure, p, in a conforming seat cushion is approximately 0.55 lb. per sq. in.[1], as determined from the simple formula, $p = w/a$ where w is the passenger weight carried by the seat cushion, and a is the total contact area. This value will vary up or down according to the weight of the passenger as the area of contact does not increase directly with the passenger load. The average static back pressure of a person sitting in a seat relaxed is by measurement approximately 35 lb., so that the unit pressure here, assuming a conforming back is very low or roughly 0.15 lb. per sq. in. From this figure it is clear that the properly proportioned back-cushion spring should be approximately one-

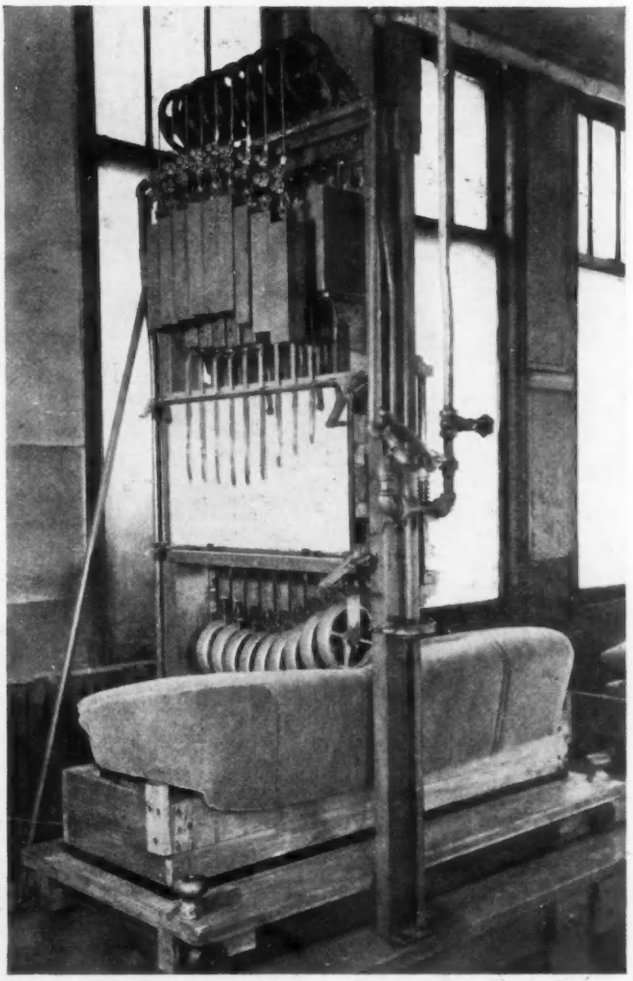


Fig. 1 – Testing Machine for Registering the Fore and Aft Contour of a Seat Cushion under an Average Passenger Load

[1] See "Properties of Cellular Rubber for Passenger-Car Cushioning," by H. E. Elden, presented at the Semi-Annual Meeting of the Society, June 20, 1935.

fourth as stiff as is the seat cushion. It should be appreciated that, although low values of p in a seat are indicative of static comfort, it is not necessarily predictive of good riding comfort.

Fig. 1 is a photograph of a specially developed testing machine for registering the fore and aft contour of a seat cushion under an average passenger load. This machine is a practical result of years of research and produces graphs like those shown in Figs. 2 and 3. The portion of weight of the average passenger supported on the floor of the car varies from 5 to 15 per cent of his total weight, depending on the height of the seat above the floor and the weight distribution of the passenger, and this factor is taken into consideration in computing the average load, which was obtained by measuring the distributed load produced by a sufficient number of widely different individuals as to weight and size. As shown in Fig. 2, a comfortable contour can be approximated by three contiguous circular arcs having radii varying in arithmetical progression. It should be noted that the actual contour of the unloaded cushion is unimportant, except that it indicates roughly the deflection rate when compared with the loaded contour line and hence the ability to absorb impacts. Fig. 3 gives the results obtained on three different conventional cushions, No. 2 cushion being by far the most uncomfortable and more fatiguing, while there is no noticeable difference between cushions Nos. 1 and 3. In the layman's language cushion No. 2 would be termed "hard."

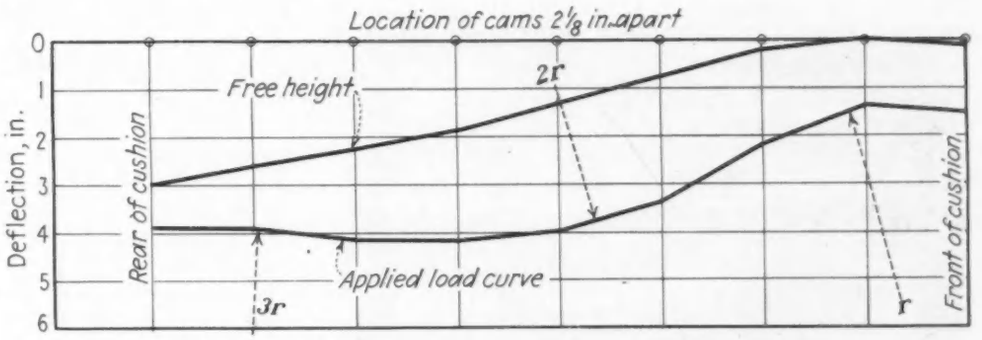


Fig. 2 – Cushion-Contour Test Chart – Conventional Front Cushion

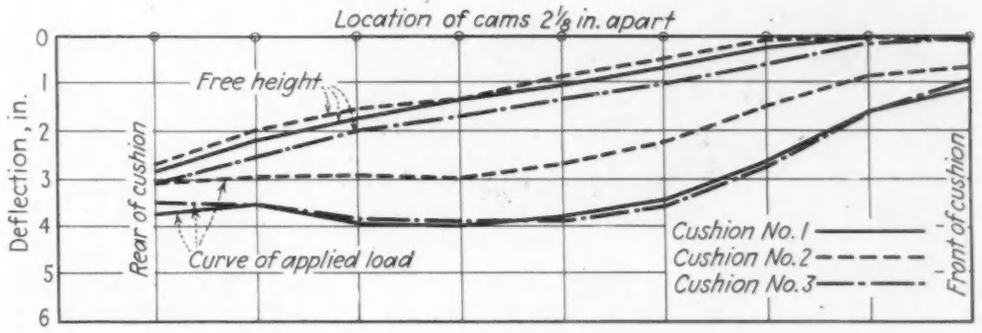


Fig. 3 – Comparison of Cushion Contours

In addition to the conforming ability of cushions and backs, closely allied with it are the angular position of the seat cushion with reference to the floor, and the included angle between the cushion and back. The former is dictated somewhat by the height of the seat above the floor or, conversely, the height above the floor is dictated by the angle of the cushion, and the latter by the relative softness of the back. The angle of the seat cushion itself should be 10 deg. to 15 deg. to the horizontal for a height above the floor of approximately 15 in., whereas the included angle should be approximately 100 deg. to permit relaxed back support. Adjustments on seats provided for varying these two angles would be very desirable to suit more nearly the requirements of each individual driver or passenger. The machine shown in Fig. 1 is also adaptable to the measurement of back-cushion contour by changing the individual loads in the machine. The criterion for correct support by the seat cushions is then dependent upon continuous transition of the cushion and back contours when the units are assembled to the seat, as shown in Fig. 4. It will be noted that the proper back contour is nearly straight. Although this machine is used primarily in production checking of cushions for consistency, it also has value in the development of cushion contour standards, and for indicating defects in cushion construction.

We might say in conclusion that the unaverage person must suffer at the expense of the average in any fixed seat design but, fortunately enough, the unaverage person is in the minority.

Step number two in the design must consider three important factors: frequency, damping, and distribution of deflection rate per unit of area. The actual deflection of the passenger in the cushion, regardless of initial unloaded shape, is a principal factor in the frequency and, omitting damping considerations, is inversely proportional to the square of the frequency. A solid sponge-rubber cushion is quite different from a common coil spring cushion of the same depth, in that the frequency of the rubber cushion is very nearly constant under all loads up to "bottoming." The true natural frequency of any cushion measured experimentally by recording the vibration of a dummy load is always higher than the theoretical, and should be considerably higher than the highest car body frequency unless the cushion is damped heavily to prevent a resonance

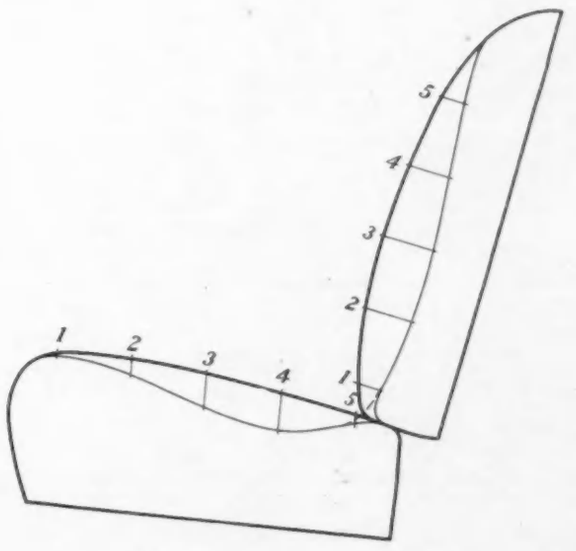


Fig. 4 – Proper Transition of Cushion Contours under Average Passenger Load

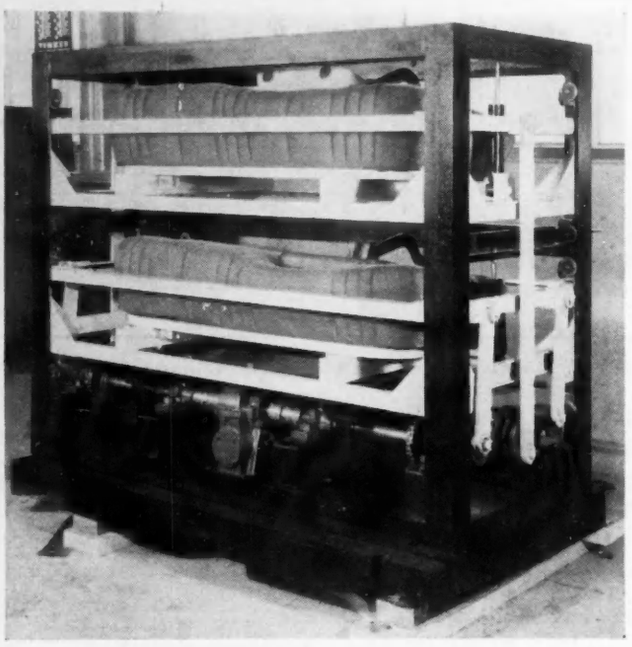


Fig. 5 – Machine for Charting Cushion Vibration and for Endurance Testing

condition which is frequently noticeable at rather low car speeds when the chassis springs are absorbing very little of the road impact energy. In Fig. 5 is shown a machine used to chart cushion vibration, and also test cushions for endurance under a vibrating load. Typical vibration records taken on this machine are given in Fig. 6.

Extremes of damping are illustrated well in this series of charts. Since it is much easier to design comfortable seat cushions with relatively high than with low frequency, principal resonance is avoided easily. Similar precautions should be taken in designing a seat back to avoid pitching resonance, which can be extremely disturbing. Inability to design against resonance completely makes damping imperative in some degree.

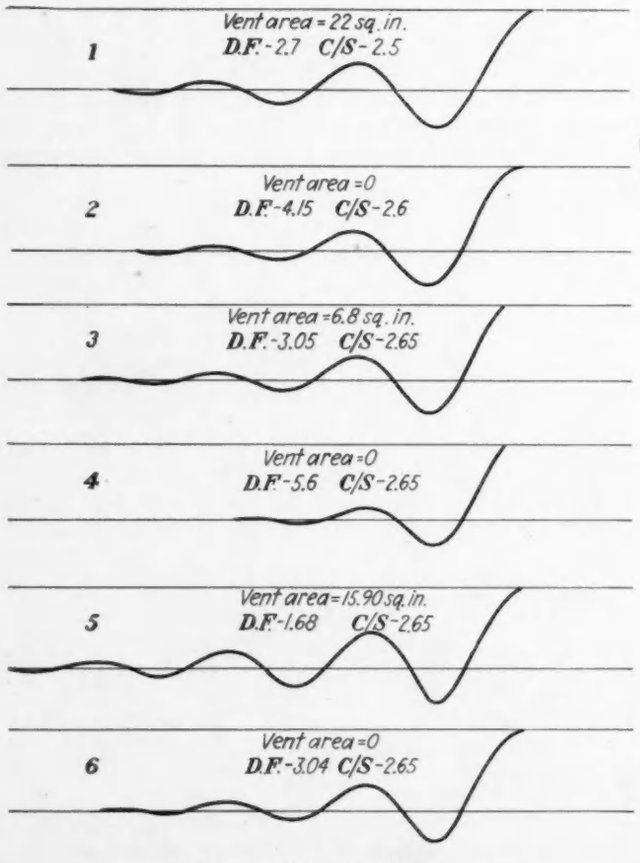


Fig. 6 – Vibration Charts

The correct degree of damping in coil-spring cushions is obtained most easily by closing up the bottom and varying the amount of airflow restriction by opening and closing vents. Fig. 7 explains graphically what can be done to change damping by this process. Cushion No. 5 is a conventional spring cushion. Cushions other than coil springs, like cellular sponge rubber, and so on, have an inherently high damping factor – undoubtedly a valuable attribute. Our experiments with a new type of cushion spring (no coils) indicate that damping can be pre-fixed in the manufacturing process, in prescribed amount without depending on complete bottom closure and vents to meter the air. A damping factor n of roughly 3.0 is considered adequate when the frequency is

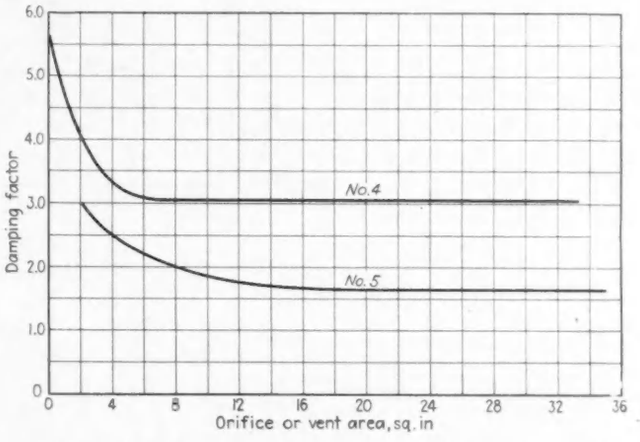


Fig. 7 – Damping Characteristics of Two Types of Cushions

higher than the highest car-body frequency. The damped vibration of a common coil spring cushion follows no definite mathematical type of damping, but apparently follows a law approaching damping according to the square of the velocity, but falling between it and constant-friction damping. Thus the following standard equation of damped vibration is used to determine damping factors from the graphs:

$$+ \ddot{mx} + p^2x = 0$$

Solving this equation for a particular case, the damping per cycle is found to be in the ratio of e^{-nt}, where t is the time of one cycle and n, the damping factor. Thus $e^{-nt} = r$, where r is the ratio of two successive amplitudes and $-n = \dfrac{t \log e}{\log r}$

Theoretically the same distribution of bodily support should exist in the cushions under impact as under static conditions and, therefore, if coils are used, the stiffness factors of the coils should vary in proportion to the pressures sustained. Thus, if the load on a center coil is 10 lb. and only 5 lb. on a front coil, the ratio of their "rates" should be approximately 2:1. This ratio is difficult to attain in a simple nest of coil springs due to the impracticability of preloading the coils to sustain high static pressures where required with low stiffness factors. Much more can thus be accomplished in closed coils where preloading is widely adjustable. Sponge rubber is a material that naturally provides an almost constant ratio of pressure to "rate" which is a result of its self-conforming capacity. Much is yet to be learned about the support of cushions under impacts and its relation to comfort, and it is a subject well worth studying scientifically for the rewards that lie ahead.

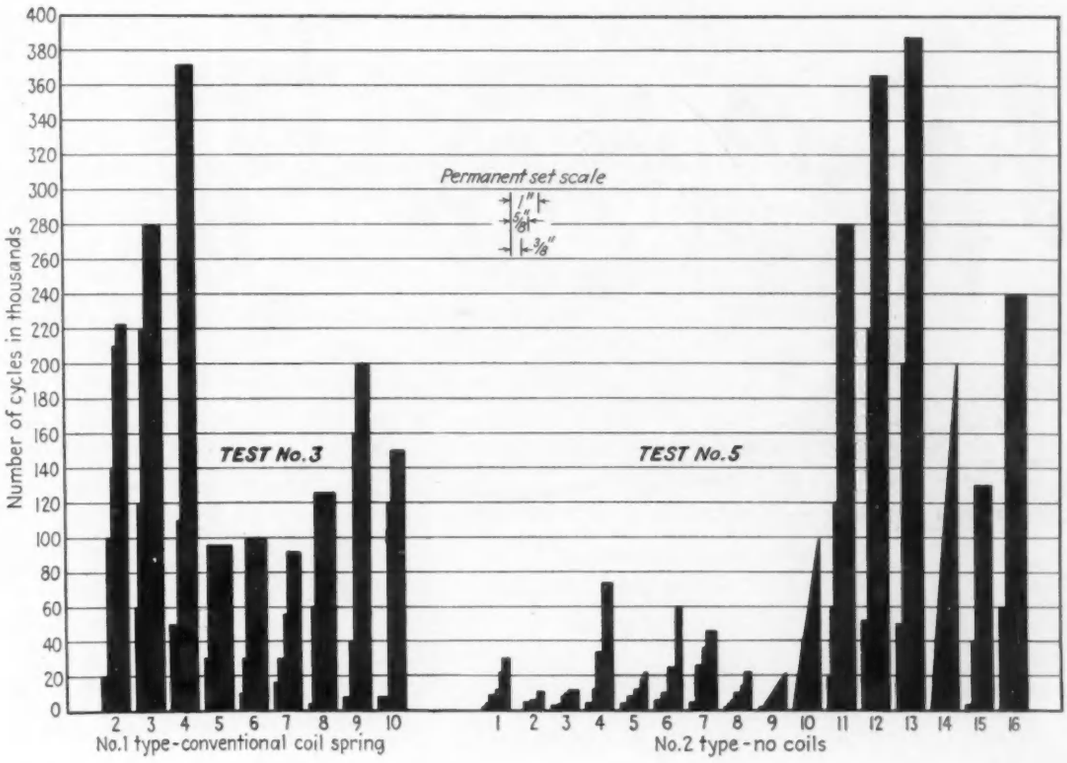


Fig. 8 – Endurance Tests Results – Comparative Results of Seat-Cushion Tests Made on Two Different Types of Cushions, Giving Permanent Set Gradients and Number of Cycles to Failure

Over 90 per cent of present-day passenger-car cushions used in this country are the coil type, consisting of a nest of coiled springs tied together and enclosed in border wires with a pad of cotton, curled hair, Sisal, or various combinations of these coverings overlapping the top of the spring. A trim cover encloses the whole assembly. In the more expensive seats the coils are cylindrical and are enclosed in individual bags before being sewed together. This arrangement enables more coils to be used, renders the whole fairly silent, and obviously conforms better and supports the pad longer.

This enclosed-coil type of cushion is recognized as a very good spring element and, when designed for uniform support, furnishes stiff competition for any of the later types of cushion-spring elements not employing coils (if we omit "weight" and "durability" from our consideration) but, due to cost, this type is used only in the higher priced cars.

Considering weight, the coil-spring element is so heavy due to its construction that its efficiency is low compared with some other springing elements. Its durability is not all that is to be desired not so much because the coils break or sag as because the pad, which is obligatory, is not 100 per cent supported, and in time under continued vibration it is forced down into the coil spaces. Some improvements in pads recently made aid this condition, but there is still room for more improvement.

Sponge rubber used generically to embrace all such cushions has the advantage over coil springs of greater conformability, but, as yet, is not far enough developed in some other phases to be desired in passenger cars. Cost here is a great advantage in favor of the coil type of spring.

The machine shown in Fig. 5, as previously stated, is used in testing the durability of a cushion under repeated vibration by raising the cushion and a normal load resting on it, then dropping suddenly the combination to cause the weight to be depressed into the cushion under the impact.

The ensuing vibration may then be recorded if desired. This operation is repeated approximately 20 times per min., which is an arbitrary figure, until a check is to be made on the cushion elements for failure. Endurance records are kept on charts similar to those in Fig. 8, showing the "set" gradient as well as number of cycles to failure. By means of this machine much valuable information is secured for improving cushion life and comfort.

Fig. 9 is a good example of the effect of damping on riding qualities of a cushion, cushion No. 4 having a very high damping factor as indicated in Fig. 6. These results were plotted from a road test made with the Chrysler Integrating Accelerometer several years ago.

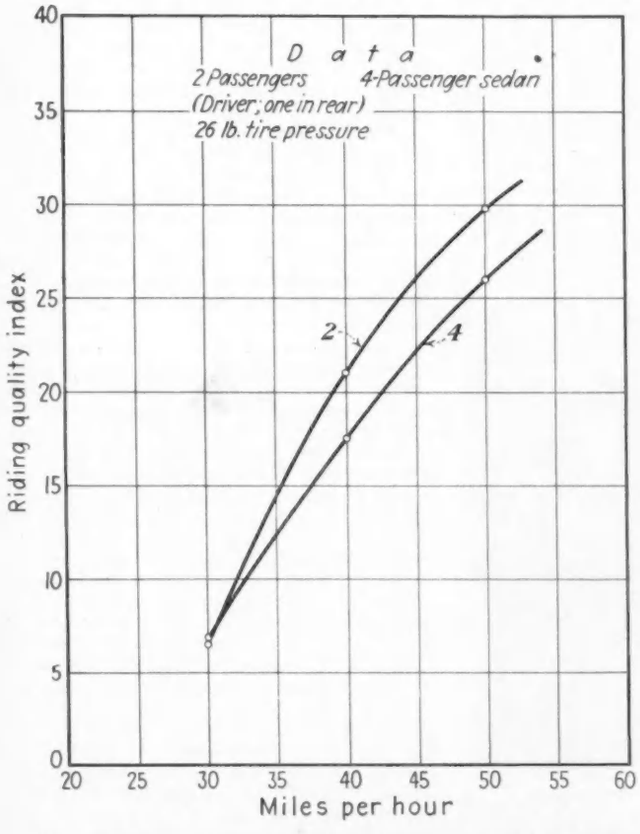


Fig. 9 – Comparison of Riding Comfort of Cushions – 4-Mile Test Trip – Results Obtained with Chrysler Integrating Accelerometer

News of the Society

"Machines Not Cause of Unemployment" – Scoville

● **Detroit**

Economics and leaf springs were the mixed fare offered at the Detroit Section's for-members-only meeting, May 23.

"Unemployment of the last eight years has not been caused by labor-saving devices," declared Chrysler Statistician J. W. Scoville, in his paper "Technology and Unemployment." "Labor-saving machines may cause temporary unemployment of persons, but I know of no evidence to prove that labor-saving devices cause general or protracted unemployment," he said, and quoted census figures to show that the percentage of population gainfully employed in the country was 38.3 per cent in 1900, 41.5 per cent in 1910, 39.4 per cent in 1920 and 39.8 per cent in 1930, despite the tremendous gains made by technology since the turn of the century.

Mr. Scoville showed that the number of persons employed in factories in 1929 was about 8,785,000 and that in the fall of 1937 this number was about 8,100,000. The November census of unemployment, he said, indicated that there were about 10,000,000 out of work. He added, "Since factory employment in 1937 was only about 685,000 less than in 1929, it is evident that these 10,000,000 unemployed persons have not been discharged from factories and cannot expect to get work in factories. The number of unemployed in November, 1937, was a million greater than the maximum number ever employed in factories. Since factory workers are only about one-sixth of the gainfully employed and only about one-ninth of the total workers, it is evident that statistics on factory employment give a very incomplete picture of employment."

J. H. Shoemaker, executive secretary of the Leaf Spring Institute, told of the intensive research work that the Institute is doing to improve leaf springs for automotive use. Karl K. Probst, consulting engineer for the Institute, said that the lower cost of steel for long, wide spring leaves will stimulate their use. He noted that there would be economy in this type because heavier gages do not call for "extras" applicable to excessively thin sizes. Wider springs would have fewer leaves, which also might cut costs, he added.

Hails New Developments As Aids to Safer Flying

● **Chicago**

Recent airplane developments herald a new era of safety in aviation, T. P. Wright, vice-president and director of engineering, Curtiss-Wright Corp., told 170 SAE members and guests at the annual aviation session of the Chicago Section held May 20 at the Chicago Municipal Airport. Speaking at the dinner which followed an afternoon inspection trip through the shops and hangars of the American Airlines and the United Air Lines, Mr. Wright stressed such developments as sealed cabins for high flying, ultra high-frequency landing systems using invisible beams, and better tapering of wings to prevent loss of lift at slow speeds. He declared that flights at 14,000 to 18,000 ft. altitudes will be common within a year.

The new Boeing 307 and the Douglas DC4 now testing, Mr. Wright said, would both fly regularly at these heights. He spoke of the new invisible beams possible through the ultra high-frequency landing systems by means of which curved radio impulses can be directed as easily as a beam of light, and stated that pilots can follow the beams easily regardless of fog, snow, rain or dust. Recent progress in aerodynamics have taught engineers how to warp the tips of highly tapered airplane wings thereby preventing loss of lift which often produces a bad stall or spin, the speaker pointed out. This improvement in wing tip design will enable pilots to slow up fast ships to safer landing speeds, he added.

Smoothing out wing surfaces to glass-like finish has been found essential in stepping up speeds, he reported, noting that skin friction in wings and hull can be reduced by removing all surface irregularities such as rivet heads and protruding points.

Cowling Shapes Changing

Already airplane speeds are approximating sound speeds – about 750 m.p.h. – said the speaker. By way of illustration, he cited the high speed movement of air over certain engine cowlings. These cowlings, he said, are now being reshaped to cut down this speed. Air flow over upper surfaces of wings is a limiting factor in plane speed. A plane may be running 400 m.p.h., the speaker declared, whereas the airflow over the wing would be 700 m.p.h.

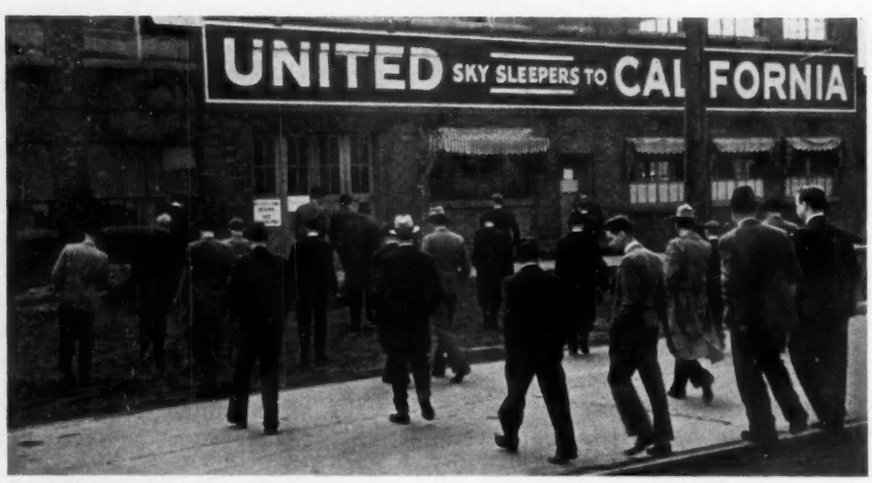
Growth in engine size, Mr. Wright said, would be proportional to present day engines and he foresees no reason why powerplants of 3000 or 4000 hp. cannot be designed and constructed with the same weight limits as present powerplants. However, he explained, as engine size increases, the weight of the propeller steps up so rapidly that this factor has become a definite obstacle to power production from a single unit. Sleeve valve engines now under development by American engine makers, the speaker pointed out, should show improvements over conventional poppet valves now universally used in this country.

Discussing future trends in airplane propeller requirements, George W. Brady, chief engineer, Curtiss propeller division, Curtiss-Wright Corp., said that important changes ahead are lighter blade construction, improved constant-speed controls of the automatic synchronizing type suitable for use on airplanes with two, four or more engines, and the acceptance of manual selective control as a useful adjunct to constant speed operation. Demand for blades of lighter weights arise from the fact that weight increase becomes serious in the larger engine sizes, since propeller diameter must increase as the square root of the ratio of engine powers, he explained. For example, he said, propeller weight for a 1100-hp. engine is 375 lb., a 2000-hp. engine calls for a 16 ft. diameter propeller weighing 775 lb.

Blade materials and softer engine drives, the speaker said, may be necessary to overcome this problem. As an aid in accurate measurement of the stress variation on running propellers, he told of recently developed testing apparatus consisting of pickups and slip rings which coordinate with recording oscillograph equipment and amplifiers. Rapid feathering is being stepped up by an increase in voltage applied to the propeller, he explained.

Analyzing problems in high-flight engineering, Kendall Perkins, Curtiss-Wright Corp., pointed out that successful development of pressurization is essential to successful transport flight at heights from 12,000 to 20,000 ft. The first airplane built for such study, he said, is the Lockheed Y1C35 made to Army Air Corps

On Tour of Inspection



Frank Bennett, Photo-Chek Service

● **Chicago**

Chicago Section members on their way to the United Air Lines' shops at the Chicago Municipal Airport where they visited the flight-instrument overhaul and testing laboratories as a part of the inspection tour preceding the Section's May 20 meeting.

specifications. Early this fall the giant Boeing transport with pressurized cabins is expected will undergo flight tests, he said. By 1939, two other transport airplanes will be available with pressurization and ample tests will be made before transport schedules will be effective at the higher altitudes mentioned which will result in higher speeds, give freedom from weather difficulties and avoid dangerous mountain peaks, he noted.

Gage Mace, assistant operations manager, American Airlines, gave an interesting discussion on "Modern Airway Traffic Control" emphasizing recent new equipment and methods which have facilitated airway operations and plane landings and take-offs at modern air terminals.

A high spot of the evening was the appearance of Major "Jimmy" Doolittle, noted speed flyer, who spoke briefly on airplane progress and transcontinental airplane operations.

William Littlewood, American Airlines vice-president, served as chairman of the technical session. He was introduced by Harry F. Bryan, chairman of the Section.

National Defense Costs $5.60 per Capita Yearly

● Dayton

"The best guarantee of peace is an effective industrial organization to back up the Army," H. A. Toulmin, Jr., of Toulmin & Toulmin, declared before the Dayton Section of the Society at its June 9 meeting. He told of the vast organized plan of industrial mobilization which has been developed by our Government under the direction of Col. Louis Johnson, the Assistant Secretary of War.

Under Colonel Johnson's direction, he said, some ten thousand firms have been allocated schedules of production in case of war which will take from 20 to 50 per cent of their capacity, leaving ample capacity for civil markets.

Mr. Toulmin pointed out that in the United States we spend only 1½ cents per day per capita for our Army, Navy and Air Corps. This $5.60 per person per year, he declared, is very small compared to England's $30, Japan's $21, France's $18, Italy's $15, Germany's $11, and Russia's $7.

We can continue this economy, he stated, if we will maintain, as we are now doing, efficient organization, intelligent preparation and economic, timely organization.

"The great cost of war is not in preparation for it," he declared, "but in making up for lack of preparation after we have once entered it, and the strange thing is that the greater the preparation, the less likelihood that we will ever have to use it."

Ignorance Blamed for Neglect of Leaf Springs

● Northwest

Service men don't know much about leaf springs, and for that reason often fail to give them the attention they deserve, Murray Aitken declared, in speaking before the Northwest Section, May 13. He added that mechanics must be educated to consider springs as parts subject to wear and deterioration.

Mr. Aitken was one of the two Kenworth Motor Truck Corp. engineers on the program. The other was R. J. Hutchinson, SAE JOURNAL field editor for the Section, who outlined the design problems of four-wheel-drive trucks.

Continuing his discussion of leaf springs, Mr. Aitken listed the six main factors that influence the cushioning and endurance qualities of a spring as: condition of all working surfaces, condition of all bearing surfaces, tension between leaves, shape of ends of leaves, number of leaves and thickness of leaves. Material changes in any of these, he said, will influence the spring's endurance and cushioning effect.

Even though a spring contains the finest steel of the finest physical qualities, it will be unsatisfactory if not custom designed for the operation it is to perform, he declared.

Mr. Hutchinson stated, "There is but one reason for driving the front axle of any truck – to obtain better traction, thereby enabling the vehicle to exert a tremendous 'push', and to operate under conditions where mud, snow, ice or lack of any surface whatever, would cause the conventional truck to become inoperative," in opening his paper.

The logical way to combine good traction with extreme maneuverability, he explained, is

S·A·E Student Branches

UNIVERSITY OF ALABAMA

Data Supplied by Raymond J. Schneller, SAE Student Branch Chairman at the University of Alabama.

JUST before Christmas in 1936 a group of automotive-minded students on the historic campus of the University of Alabama received word from the SAE Council that their petition to establish an SAE Student Branch had been granted. This was on Dec. 16. The organizing group, guided by Prof. H. Walker Moore of the University's mechanical engineering department, has enlarged its membership and sponsored activities that have made the Student Branch prominent on the campus.

Members of the Branch have worked under Prof. Otto Lunde in designing and building for the aeronautics laboratory, a simple return wind tunnel which has a throat of 9 sq. ft. The Branch itself designed a display for "St. Pat's Day," a class day for the senior engineering students, which consisted of a chassis and illustrations of the various working parts of an engine.

At the Branch's monthly meetings members of the University Reserve Officers' Training Corps faculty have talked on military functions of airplanes and automotive units, and pilots and faculty members have spoken on various aspects of commercial aviation. Technical motion pictures supplied by aircraft and automotive companies have made up other programs.

The University has a total registration of about 5000 students, of which some 1200 are co-eds. There are more than 600 students in the Engineering College – including two women.

Almost 120 years ago, in 1819, the Congress of the United States donated 46,800 acres of land, rich in mineral deposits, within the newly established State of Alabama, for the endowment of a seminary of learning. It was not until 1831 that the University of Alabama was opened for the admission of students at Tuscaloosa, its present site.

Came the Civil War – and in 1865 a body of Federal cavalry set fire to, and completely destroyed, all of the public buildings of the University, with the exception of the astronomical observatory. It was four years before reconstruction was

(*Continued on page* 47)

to limit the truck to two axles, both driven, and to provide sufficient front overhang so that the weight distribution when carrying full equipment approaches 50-50. This, he added, necessitates careful attention to the steering mechanism so that the truck may be handled easily.

"Certainly one of the prime requisites of a four-wheel-drive truck is a good free-running differential between axles, with a control for locking the differential when either axle tends to lose traction," Mr. Hutchinson continued, adding, "the best lock appears to be one that may be controlled manually at the driver's option."

Universal joints in this type of truck, he said, must have large torque capacity, excellent high-angle characteristics and the ability to retain their lubricant under most adverse conditions. He also pointed out that in some designs transfer cases must always be operating as reduction units, resulting in excessive gear and bearing wear.

Mr. Hutchinson noted that most transmission failures result from the use of transmissions of insufficient size and capacity. In no other truck service are transmissions put to such a severe test as they are in four-wheel-drive trucks, he declared. Long periods of operation in the lower gears at or near maximum engine torque causes extremely high tooth and bearing pressures that will result in failure unless transmissions of sufficient reserve capacity are installed, he concluded.

Maintenance Methods Lag

Responding to his own question: "Has Maintenance Kept Pace with Transportation?" O. M. Brede, director of service, General Motors Truck & Coach Div., Yellow Truck & Coach Mfg. Co., answered "No" in his paper presented before the Northwest Section's April 22 meeting, by R. C. Oliver of the same company.

"Looking back over the rapid evolution of transportation," the author said, "we observe that maintenance methods have not kept pace. With all due credit to fleet operators who have recognized this science of operation, we feel that the large majority of motor-vehicles in the United States are repaired only when they fail to operate or when the need for repairs is so obvious that the owner's conscience demands them.

"The skill and knowledge which a real mechanic spends years to obtain has been discounted in too many cases by non-thinking operators. The wages which a skillful workman justly deserves have not been paid in all instances. Mechanics have been called upon to work miracles under working conditions unfit for coolie labor. The yes and no of mechanical maintenance is vested too often in personnel totally unfamiliar with the problem."

Mr. Brede declared that a man deserving of the name "mechanic" must be well educated, have good habits, practice personal cleanliness, and be a far-sighted individual who recognizes and practices the theoretical as well as the practical side of maintenance.

GM Proving Ground Host To SAE Student Branch

● **G.M.I.**

The SAE Student Branch at General Motors Institute paid its annual visit to the General Motors Proving Ground at Milford, Mich., May 17. Two buses were chartered to provide transportation for the 54 members and applicants who made the trip; the largest SAE turnout on record at GMI.

History of the proving ground and a brief explanation of the construction and purpose of the various types of road on the course, by C. E. Farrell of the Proving Ground staff, and motion pictures illustrating the activities of the General Motors Research Laboratories and the Proving Ground opened the meeting.

The students then made a tour of the course and visited the new Proving Ground sound laboratory.

Following dinner the group heard T. J. Carmichael, in charge of instrumentation at the Proving Ground, talk on the development and application of the various special instruments that they use. In particular, he sketched the development of the decelerometer and a special device developed at the Proving Ground for measuring the volume of combustion chambers by sound. Working models of these instruments were displayed and operated.

Famous Drivers Set Pace at Race Meeting

● **Indiana**

Tazio Nuvolari, famous Italian racing driver and winner of the 1936 Vanderbilt Cup race, was a surprise guest at the Indiana Section's race meeting, May 26. He was introduced by another famous driver, Pete DePaolo, winner at Indianapolis in 1925, who gave a humorous account of early races and told of his experiences as pit chief for Kelly Petillo when he won in 1935. Mr. DePaolo also recalled having Nuvolari as his mechanic at the Grand Prix in Italy, and how he allowed Nuvolari, then a motorcycle pilot anxious to drive a car, to try out his job and "feex it complete" by smashing it into a wall.

Louis Schwitzer, a member of the A.A.A. technical committee, as master of ceremonies, started the meeting by reviewing Indianapolis races since 1909 when the track was built.

Wilbur W. Shaw, who took the race in 1937, gave a frank and humorous account of the woes of a pilot who gets his car O.K. and then has a wild idea of "improvement"—and makes it. Rain comes, he said, and the driver can't try his car until the time trials, when he finds that he can hardly keep it between the walls. The driver then tosses the "improvement" away and finds his car runs better than ever, Mr. Shaw concluded.

Ab. Jenkins, who has burned up the salt beds of Utah in setting records at Bonneville, gave a candid account of what it is like to do 150 m.p.h. and better for 24 hr., and Lee Oldfield spoke of some new things that have made appearance at the track this year.

Most of the members were at the track watching the elimination and time trials in the afternoon, and as a result many of them were late for the dinner which didn't get started until almost eight. The 83 who sat down to eat grew to 250 when the general meeting was called to order.

Airline Destroys All Motors After 6000 Hr.

● **Oregon**

A busy week end for Oregon Section members started with an aviation meeting at Swan Island Airport, Friday, May 13, and ended at a joint session with the Student Branch at Oregon State College at Corvallis, Saturday evening, for awarding prizes to winners of the Section's student paper contest.

The facts that United Air Lines spends about $1000 per week for spark plugs and that it destroys all motors after 6000 hr. of service were highlights of the discussion following an informal talk by David Ellis, United Air Lines assistant mechanic, in which he gave a detailed outline of the maintenance methods used by his company.

The program continued with an illustrated paper explaining the procedure used in gathering and dispensing weather reports, presented by A. Carpenter, meteorologist with the United States Department of Commerce. He described every detail of a day's routine in his office. Capt. Walter Eefson, assistant superintendent of flying for United Air Lines, concluded the

(*Continued on page 46*)

SAE Student Branch Visits GM Proving Ground

● **G.M.I.**

Fifty-four members and guests of the SAE Student Branch at General Motors Institute visited the General Motors Proving Ground at Milford, Mich., May 16. At the left are E. K. Harris, faculty adviser; R. F. Grogan, Section A secretary-treasurer, and W. A. Hasbany, Section A vice-chairman, of the Student Branch, inspecting a model of the proving ground. The student group is shown at the right.

1938 SAE Summer Meeting

(*Continued from page 24*)

Aircraft Engine Sessions

Chairmen

Arthur Nutt **R. N. DuBois**

Robert Insley

Supremacy of the poppet valve in American aero engines received a strong challenge from across the sea at the first Aircraft Engine Session where the world's leading authority on the single sleeve valve for aircraft compared its design, operation, and advantages with those of the poppet valve. In the spirited discussion that followed, leading American aircraft-engine engineers were about evenly divided pro and con.

In the second session, aircraft-engine, supercharger, and heat-transfer engineers got their first taste of fundamental data on the exhaust turbo supercharger and asked for more; and the C.F.R. report on rating aviation fuels in full-scale engines was read and discussed.

Debate in the final session centered around how to make thinner and thinner fins; whether the aircraft-engine manufacturer should also build the engine cowling and exhaust system; and just what properties of aircraft-engine lubricants are most important.

The Single Sleeve as a Valve Mechanism for the Aircraft Engine – *A. H. R. Fedden, Bristol Aeroplane Co. Ltd.*

There is no reason, Mr. Fedden predicts, why single-sleeve-valve aero engines should not eventually supplant completely existing types equipped with poppet valves with their inherent fundamental problems, especially for military and commercial craft.

The single sleeve valve has now passed from the experimental to the production stage with hundreds flowing through the Bristol factory, and the author sees ahead a vast field of research yet to be explored.

Among the nineteen inherent advantages claimed for the sleeve-valve engine over the poppet-valve type by Mr. Fedden are quieter operation, higher compression ratio with its attendant benefits, absence of maintenance except for plugs and magneto servicing, and complete enclosure of all working parts. Data comparing the two types are given in detail.

The paper starts by giving a historical background of the sleeve-valve internal-combustion engine from 1905 when Charles V. Knight first began work; then carries on with the development by different groups until the Bristol Company entered the field.

Then follows a resume of Bristol single-cylinder research, and subsequent main-engine development, giving particulars of type tests together with flight-testing of the Bristol sleeve-valve engines. The author announces that more than 10,000 hr. of main-engine running and flying have been attained on the Bristol sleeve-valve types to date.

Discussion

Slow-motion pictures of the single sleeve valve in operation, displayed by Mr. Fedden immediately after his reading, gave a clear picture of the design of the valve mechanism and the elliptical motion of the valve.

Challenging many of the advantages claimed by Mr. Fedden for the single-sleeve-valve engine, Chairman Nutt contended, in written discussion, that there should be no difference in the maintenance required for the single-sleeve-valve or the poppet-valve engine. The checking of tappet clearances at 100-hr. periods on poppet-valve engines, he explained, actually is a habit rather than a necessity, although admittedly the habit remains "because of an affliction long since overcome."

Referring to the paper's comparisons between the two engine types, Mr. Nutt called attention to the fact that Mr. Fedden used a four-valve Bristol engine for his poppet-valve example and suggested that a more favorable comparison might have been obtained if the sleeve-valve engine had been compared with a modern two-valve poppet-valve engine.

Answering Mr. Fedden's question, Mr. Nutt opined that direct injection has not made greater strides in this country primarily because of higher cost, reduced reliability, and the low state of development of a satisfactory fuel-air ratio device. However, he added, the use of low-volatility fuels may revive the development of the fuel-injection system.

Recent progress in the design and lubrication of poppet valves and valve gear was reviewed in prepared discussion by A. T. Colwell, Thompson Products, Inc., who pointed out that exhaust valves have operated 5000 hr. and more and that their ultimate life, as yet, is unknown. I would like to see sleeve-valve and poppet-valve parts compared after 5000 hr. of similar operation, he concluded.

S. D. Heron, Ethyl Gasoline Corp., pointed out that the salt- and sodium-cooled valve, as it is known in this country, was developed by the U. S. Army Air Corps at McCook Field, and did not originate at the Royal Aircraft Establishment at Farnboro, as stated in Mr. Fedden's paper. Mr. Heron explained that he was associated with the work on valve cooling at both Farnboro and McCook Field.

By no means has the poppet valve reached the limit of its development, believes Vincent C. Young, Wilcox-Rich Division of Eaton Manufacturing Co., and higher outputs and more satisfactory service can be obtained by careful attention to detail. How was the problem of oil control solved in the development of the sleeve valve?, he asked.

Announcing that he was both a sleeve-valve critic and an enthusiast, Robert Insley of Pratt and Whitney Aircraft stated that he was inclined to minimize the inherent performance ad-

Informal Photographic Exhibit Creates Interest in SAE Contest

More than 50 pictures taken by SAE members attracted an unusual amount of interest at the Society's informal photographic exhibit at White Sulphur Springs.

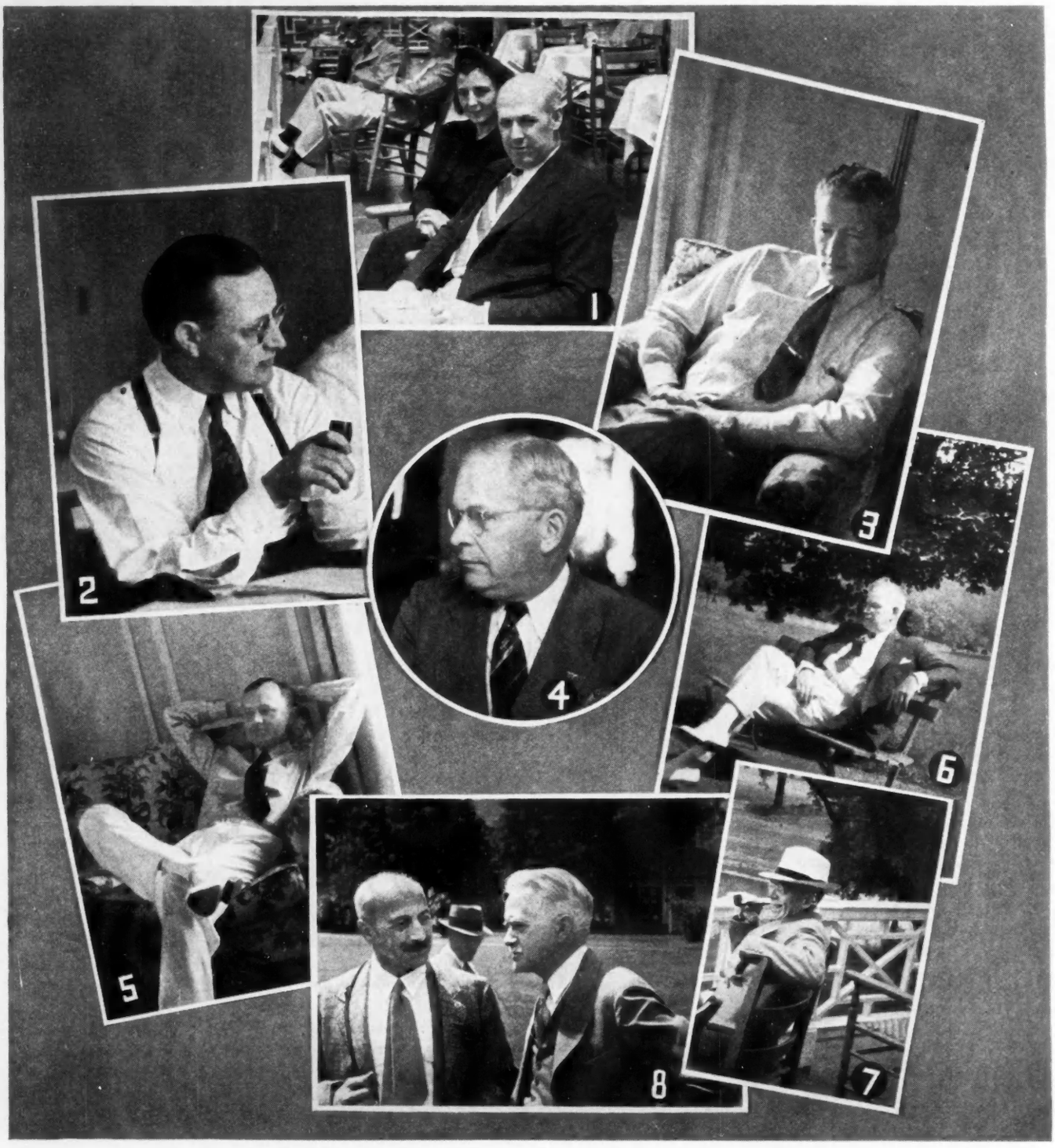
Hector Rabezzana's study of a violinist won the first prize and second prize went to Tore Franzen for his candid shot of Gen. Hugh S. Johnson and Fred M. Zeder. Honorable mention was accorded photographs by Mr. Rabezzana, P. S. Tice and Leslie Peat. Judges were Nathan Lazarnick, E. Y. Watson and Herbert Hosking.

The Summer Meeting marked the opening of the First SAE Photographic Contest. Amateur photographers who are members of the Society are eligible to compete in this contest which closes Dec. 31 of this year. Pictures selected by the committee will be hung at the Society's Annual Meeting in Detroit, Jan. 9-13, 1939.

Contestants may enter up to three pictures in each of the following groups: Society Activities, Industrial, Home, Pictorial and Summer Meeting.

A complete set of rules may be obtained from SAE Headquarters at 29 West 39th Street, New York.

Camera Studies at the 1938 Summer Meeting



1. Dr. and Mrs. R. E. Wilkin
2. F. L. Faulkner
3. H. E. Simi
4. F. B. Willis
5. W. K. Creson
6. A. J. Schamehorn
7. W. G. Wall
8. Hector Rabezzana and E. C. Newcomb

vantages of the sleeve valve and to emphasize the advantages of fewer parts and maintenance simplicity.

Attractive advantages for the in-line air-cooled engine are offered by the sleeve valve, such as the elimination of the overhead camshaft and housing and the possibility of higher speeds and cylinder pressures, pointed out A. T. Gregory, Ranger Engineering Corp. The cost of these gains, however, he continued, would be a loss in compactness of the engine as a whole, and the problem of crankcase design would become serious in an engine of extremely high output.

"Mr. Fedden is even modest in his claims for the single-sleeve-valve engine," contended R. N. DuBois, Aviation Manufacturing Corp., Lycoming Division. In single-cylinder development work, he reported, we proved definitely that the

single-sleeve-valve cylinder is many octane numbers better than the poppet-valve cylinder.

Poppet valves can sag or deteriorate slowly – the springs can give way or they can seat imperfectly, pointed out P. B. Taylor, Wright Aeronautical Corp. But, with a sleeve valve, he continued, if it falters at all, it is a complete catastrophe – you don't need to look at it to find out that something is wrong. In appraising new developments from across the sea, he cautioned, let us be sure that we are not influenced unduly by the complex that makes the grass seem greener on the other side of the mountain.

In prepared discussion read by Oscar Schey of the same organization, Carlton Kemper, National Advisory Committee for Aeronautics, presented data that show the large improvements in exhaust and intake areas that can be obtained by the use of the sleeve-valve mechanism.

N. N. Tilley, Continental Motors Corp., called attention to the fact that the sleeve has practically no motion at the maximum cylinder pressures.

The low inherent fuel consumption of the single-sleeve-valve engine is what impressed him most, stated Dr. George W. Lewis, National Advisory Committee for Aeronautics. How large can sleeve-valve engines be built?, he asked.

Answering Mr. Nutt first, Mr. Fedden agreed that use of a modern two-valve poppet-valve engine in the comparison would have been more favorable to the poppet-valve engine in some ways, but the sleeve-valve engine would still be superior because of its "better breathing mechanism," especially at higher speeds. This breathing superiority, he contended, is an undeniable mathematical fact.

"The very fact that the poppet valve needs all this tricky work, such as boring out and filling up, indicates that the time is not far off when it will come to the end of its tenure," he contended, referring to Mr. Colwell's discussion. The longest service of a sleeve-valve engine has been 1400 hr., he announced; and the valves go 400 hr. between overhauls.

Mr. Heron is correct about the origin of the salt- and sodium-cooled valve, Mr. Fedden conceded, thanking him for bringing the error to his attention. Oil control has not been much of a problem, he told Mr. Young, stating that straight mineral oil is now used to lubricate the sleeve valves.

Several British companies are now using sleeve valves for in-line engines, he told Mr. Gregory, although adding that they are more advantageous in radial engines.

Double-row 18-cylinder engines of 2000 hp. are about as far as we can go in the present stage of development, Mr. Fedden believes, in answer to Dr. Lewis' question. In the larger powers, he added, operating costs seems to indicate heavy-oil engines.

Supercharger Installation Problems – *A. L. Berger and Opie Chenoweth, U. S. Army Air Corps, Wright Field.*

That the efficiency and performance of superchargers on aircraft engines depend heavily upon the character of the particular installation, is the authors' theme. Accordingly, they stress the application of superchargers and their accessories to engine-airplane installations rather than the design details of the superchargers themselves. They evaluate the relative influence of supercharger inlet temperature, supercharger inlet duct pressure drop, and intercooler pressure drop. Four disadvantageous results of high intercooler pressure drop are listed.

An important result of a study of the power required to drive superchargers for large engines is a formula for "installation efficiency," which the authors have established as a barometer of installation excellence.

Two much-discussed problems of supercharging are considered – the method of driving the centrifugal compressor and the location of the carburetor with respect to the supercharger. Reporting the results of laboratory tests, the authors announce that it is possible to obtain take-off power by the use of an exhaust-driven supercharger.

Discussion

A plea for practical design information from the Army Air Corps on the exhaust turbo supercharger was voiced by Arthur Nutt, Wright Aeronautical Corp., in written discussion. The authors' paper points out the penalties of not making a satisfactory installation and some of the advantages of the exhaust turbo supercharger, he said, but leaves the designer in the dark on exactly how to make a satisfactory installation.

Many of the same problems will come up in the development of either the gear-driven supercharger or the exhaust-turbo-driven supercharger, in the opinion of Richard S. Buck, Pratt and Whitney Aircraft. These problems will not be solved, he believes, until these types are tested side by side in service. The exhaust turbo supercharger has fundamental advantages, he continued, but its installation is more complicated. A combination of the two may be necessary for take-off, he concluded.

S. R. Puffer, General Electric Co., stressed the necessity for close coordination between the builder of the plane engine and the supercharger manufacturer to obtain an efficient supercharger installation. It might be better to designate the "installation efficiency" mentioned by Mr. Chenoweth as "overall installed efficiency," he suggested.

Turbines and superchargers of such large size that "we will stop thinking of what kind of a supercharger we will use on our engine, and instead be inquiring what kind of an engine we will use on our supercharger and turbine," were envisioned by Oscar Schey, National Advisory Committee for Aeronautics, in prepared discussion. Mr. Schey displayed charts that showed the increasing advantages of the exhaust-driven supercharger over the gear-driven supercharger as altitudes increase. He concluded by pointing out that the difference in net engine power between the two supercharger types at high altitudes or at high boost pressures at moderate altitudes is so great that it rules the gear-driven supercharger entirely out of the picture.

"Mr. Chenoweth has painted his picture of the gear-driven supercharger a little too black," opined F. M. Owner, Bristol Aeroplane Co., Ltd. Our experience shows, he reported, that the power losses in two-stage gear-driven superchargers are much lower than those that he has indicated.

A method of testing the two supercharger types by comparing the indicated and brake horsepowers obtained with each, was outlined by Kenneth Campbell, Wright Aeronautical Corp. He also pointed out that better results can be obtained if an aircraft engine is designed especially for an exhaust turbo supercharger than if the supercharger is merely put on as an afterthought.

Three more discussers joined with Mr. Nutt in urging the release of additional practical data on supercharging, especially on intercooler forms: F. M. Young, Young Radiator Co.; S. K. Hoffman, Aviation Manufacturing Corp., Lycoming Division; and J. L. Goldthwaite of Allison Engineering.

Asked for his opinion on disconnecting the gear-driven supercharger during cruising and using fuel injection, by S. D. Heron, Ethyl Gasoline Corp., Mr. Chenoweth replied that this method has many attractive features, one of the most important of which is fuel economy.

"We are on the threshold of submitting more fundamental data, especially on how to build an intercooler," Mr. Chenoweth announced in reply to numerous requests. We do not believe that the exhaust turbo supercharger is a cure-all, but we do believe that it is the answer to high-altitude flight, he concluded.

Rating Aviation Fuels in Full-Scale Aircraft Engines – *H. K. Cummings, Director C.F.R. Full-Scale Detonation Projects.*

Although the octane scale has not been defined beyond 100, this report announces that tetraethyl lead in C.F.R. S-1 reference fuel is now used as a tentative standard for evaluating the knocking characteristics of

fuels higher than 100 octane number. It is concluded tentatively that unleaded iso-octane blends of 84 A.S.T.M. octane number or more will be lower in full-scale knock rating than leaded blends of equal A.S.T.M. octane number containing in excess of 2 cc. of tetraethyl lead per gal., and that unleaded blends thus should be regarded with caution for full-scale service. It also is pointed out that benzol blends will not generally be equal in full-scale knock rating to leaded blends of equal octane number when this number is in excess of 84.

Data in this report represent work carried out in accordance with assignments made in the first report of the C.F.R. Committee presented at the 1936 Annual Meeting of the Society, as follows:

1. Establish the validity of the C.F.R. Recommended Procedure for Rating Fuels in Full-Scale Aircraft Engines for fuels above 87 octane number.

2. Conduct full-scale engine tests in the range from 87 octane number to the highest octane number available.

3. Concurrently with Assignment 1, develop or revise knock-test methods leading to correlation with full-scale engine data.

The data presented are in accordance with Assignments 1 and 2, and the data required for Assignment 3 have been obtained in part. Further tests on olefinic fuels are reported.

Discussion

Personal agreement with the findings of the Committee was registered by M. S. Kuhring, National Research Council of Canada, the first to rise in discussion.

The work will solve the immediate problem of fuel specifications, contributed T. B. Rendel, Shell Petroleum Corp. However, he added, it will not predict results on experimental fuels. After explaining how the method of rating was arrived at, he outlined the work that lies ahead in reaching an agreement on a scale for fuels above 100 octane number. Supplementary remarks by S. D. Heron, Ethyl Gasoline Corp.; J. O. Eisinger, Standard Oil Co. of Ind.; and Chairman DuBois, concluded the session.

Cylinder Cooling and Drag of Radial-Engine Installations – *Kenneth Campbell, Wright Aeronautical Corp.*

Reduction in the baffle pressure drop required to cool promises a great reward from every standpoint, Mr. Campbell asserts, and further progress in this direction is theoretically possible through both fin and baffle development. Present aluminum-alloy head fins, he continues, are still at least twice too thick for their height, and the limiting factor in fin design is no longer engineering knowledge but the manufacturing art.

The cooling problem presents a "potential limitation" to the engine manufacturer, Mr. Campbell points out, explaining that two conflicting requirements must be met, each of which grows more severe as engine powers and airplane speeds increase. The first requirement dictates that, for the improved engine, the rate of waste-heat transfer must be increased whereas the second requires that, for the improved airplane, the cooling drag must be decreased.

The engine manufacturer can improve the rate of heat transfer either by increasing the velocity of the cooling air past the surfaces, or by increasing the area of the useful heat-transfer surface, the author states. He then shows that the latter method is far less costly, especially when done by adding to the height of existing fins and increasing the cross-sectional area of the heat-transfer passages.

Data are presented to enable the cowl designer to provide the effective cowl exit-slot width necessary at his particular indicated air speed to meet the baffle pressure drop requirements specified for the conditions.

Three main avenues of approach to the problem of increasing the low baffle pressure drops existing at very low airplane speeds in order to obtain the velocity of cooling air necessary for increased heat rejection, are studied:

1. Use of the propeller slipstream to induce a depression after the baffle passages.

2. Use of the propeller slipstream to build up a pressure before the baffle passages.

3. Use of a fan for either purpose.

Discussion

The location of the exit slot appears to be less of a problem for the in-line engine than for the radial, contributed A. T. Gregory, Ranger Engineering Corp., in written discussion read by Chairman Insley. If the slot is at the rear of the engine, the cooling air follows a direct path from the cylinders to the outside of the cowl, he explained. If the slot is at the front, he continued, a single turn is required and, with a streamlined fuselage, it has been found desirable to locate the exit slot slightly forward of the maximum cross-section of the fuselage. Vanes also have been used successfully on in-line-engine installations to build up pressures at the front of the engine, he reported.

"It is a little astonishing to us in England that the American engine manufacturer is willing to leave the responsibility for cowling design to the airplane builder," commented F. M. Owner, Bristol Aeroplane Co., Ltd., after corroborating many of Mr. Campbell's findings. British practice, he explained, is tending rapidly towards the supply of powerplants complete with exhaust system and engine cowling, and the aircraft manufacturer's collaboration in the design of the remainder of the nacelle fairing is sought carefully.

Mr. Owner's point was endorsed by T. P. Wright, Curtiss-Wright Corp., who expressed the belief that such a practice would benefit both the engine and the plane as a whole.

"One of the most important among the present deficiencies pointed out by Mr. Campbell appears to be the 35 to 40 per cent of the nacelle drag that results from the turbulence in front of the engines," remarked Weldon Worth, U. S. Army Air Corps, in written discussion, "Test results that should be forthcoming if Mr. Campbell reduces to practice some of the obvious solutions stimulated by his analysis, will be awaited with interest," he concluded.

Serious doubt as to the ability of the foundry art to make the thinner and higher fins urged by Mr. Campbell was voiced by G. D. Welty, Aluminum Co. of America. Instead, he suggested attaching sheet metal or wrought-iron fins of the desired dimensions to the cylinder-head by means of a joint giving best heat transfer.

To illustrate Mr. Welty's point, Oscar Schey, National Advisory Committee for Aeronautics, displayed a picture of an experimental cylinder of such a construction. Tests so far indicate that this thin-fin construction works successfully, he reported.

Replying first to Mr. Owner, Mr. Campbell pointed out the obstacles that obstructed the building of complete installations by the engine manufacturer in America, such as the difficulty of standardizing installations because of the great variety of commercial and military applications for standard powerplants. He agreed, however, that such a practice had definite advantages.

Aircraft-Engine Lubrication – *E. L. Bass and C. H. Barton, Asiatic Petroleum Co., Ltd.*

It may be necessary to compromise among the ring-sticking, sludge-forming, and corrosion properties of oil for civil aircraft engines, the authors suggest. No laboratory tests are yet able to predict the performance of an oil in an aircraft engine, they contend, and therefore, full-scale engine tests are necessary for final judgment. However, they explain, much preliminary work can be carried out in suitable small units.

To illustrate the complexity of the problem the authors set forth five requirements for an aircraft-engine lubricant:

1. It must not cause ring-sticking under the full-throttle detonating conditions of take-off.

2. It must not cause ring-sticking under weak-mixture cruising conditions.

3. It must give freedom from sludging so that there is no ring-jamming, so that the oil scrapers are kept free, and so that the overhaul periods are not limited.

4. It must provide protection from cold corrosion.

5. It must not be corrosive to special alloys, such as cadmium-base bearings.

Test data which are treated in the appendix of the paper, include specifications of the single-cylinder 250-cc. engines used for ring-sticking tests; and of the 500-cc. single-cylinder engine for sludge-testing. Results of these tests are correlated with single-cylinder aircraft engine, full-scale bench, and flight-test results.

In a discussion of engine results, the paper takes up the influence of mechanical conditions; carbon formation; sludging; effect of lead content of the fuel; ring-sticking and dopes; and bearing corrosion.

Discussion

Mr. Bass did not mention one important requirement of aircraft-engine lubricants, pointed out Almon L. Beall, Wright

Aeronautical Corp., namely that of maximum film strength to maintain wear at a minimum. Some of the corrosion that Mr. Bass reported may have been due to scuffing from low-film-strength oils, he suggested. We have found that tests in prototype cylinders over long periods for ring-sticking have been more useful than those in high-temperature laboratory engines, he reported.

It is only a matter of time when the aviation industry can take advantage of the solvent-treated oil developments that have been worked out for the Diesel industry, predicted Dr. Ulric B. Bray, Union Oil Co. of Calif. Then solvent-treated aviation oils will be available that are not corrosive to bearings and will not form sludge, he explained.

Agreeing with Mr. Beall on the importance of securing maximum film strength, Mr. Bass confessed that he knew no method of predicting film strength successfully. We have been interested in compounded oils, he replied to Dr. Bray, and we hope that future developments will overcome their present limitations for aircraft-engine use.

Diesel Engine Sessions

Chairmen

F. G. Shoemaker **T. B. Rendel**

An interpretive review of the design features and trends of European automotive Diesels was the first attraction that drew an overflow crowd of more than 200 into the first session. The second feature, a well-prepared and presented case for oils compounded with soap-type additives, stimulated eloquent discussion over various methods to reduce scratching and scuffing.

A step-by-step account of the engineering design and development work behind the General Motors automotive Diesels in the second session explained why these engines compare favorably in size, weight, and power with gasoline engines.

Comedy relief was provided in the second paper by a "believe-it-or-not" collection of humorous and curious anecdotes gathered from experience in the field merchandising and servicing Diesel tractors and construction equipment.

Some Recent European Developments in High-Speed Diesel Engines – *P. M. Heldt, Automotive Industries.*

The two-stroke cycle is in the ascendancy in European Diesel engine development, especially for aircraft, Mr. Heldt reports, even though most of the European Diesels operating today, with the exception of the Junkers, are of the four-stroke cycle type. The author explains that automotive-type Diesel engines are being used much more extensively in European countries than in the United States, principally because of the much greater differential between the cost of carburetor-engine fuels and Diesel fuels in Europe.

Of 176 European automotive Diesels for which specifications were published recently in *Automotive Industries*, Mr. Heldt points out that 55 have direct injection; 53 have precombustion chambers; 49 have turbulence chambers; and 19 are the air-chamber type. The turbulence-chamber type, he explains, predominates in England, and the precombustion-chamber type, in Germany.

Specifications are listed for eight Diesel engines that either are actually being fitted into stock European passenger cars, or are recommended for the purpose. Design features of a wide range of French, English, German, Swiss, and Czech Diesels are discussed in considerable detail. Railcar and aircraft Diesels also are touched upon.

Considerable space is devoted to a discussion of the Saurer light, high-speed Diesel in which are described its dual-turbulence chamber located in the piston; its annular-slot injection nozzle; its automatic timing device for injection pumps; and the instrumentation in the Saurer laboratories.

Sports Results and a Few of the Sportsmen

GOLF TOURNAMENT

MEN'S CHAMPIONSHIP FLIGHT

Winner	**– A. W. Anderson**	**156**
Runner-up	**– A. T. Colwell**	**157**

CLASS "A" FLIGHT

Winner	**– C. V. Williams**
Runner-up	**– G. W. Kuhlman**

CLASS "B" FLIGHT

Winner	**– T. S. Kemble**
Runner-up	**– P. H. Oberreutter**

CLASS "C" FLIGHT

Winner	**– Clinton Rector**
Runner-up	**– G. A. Round**

LADIES' CHAMPIONSHIP FLIGHT

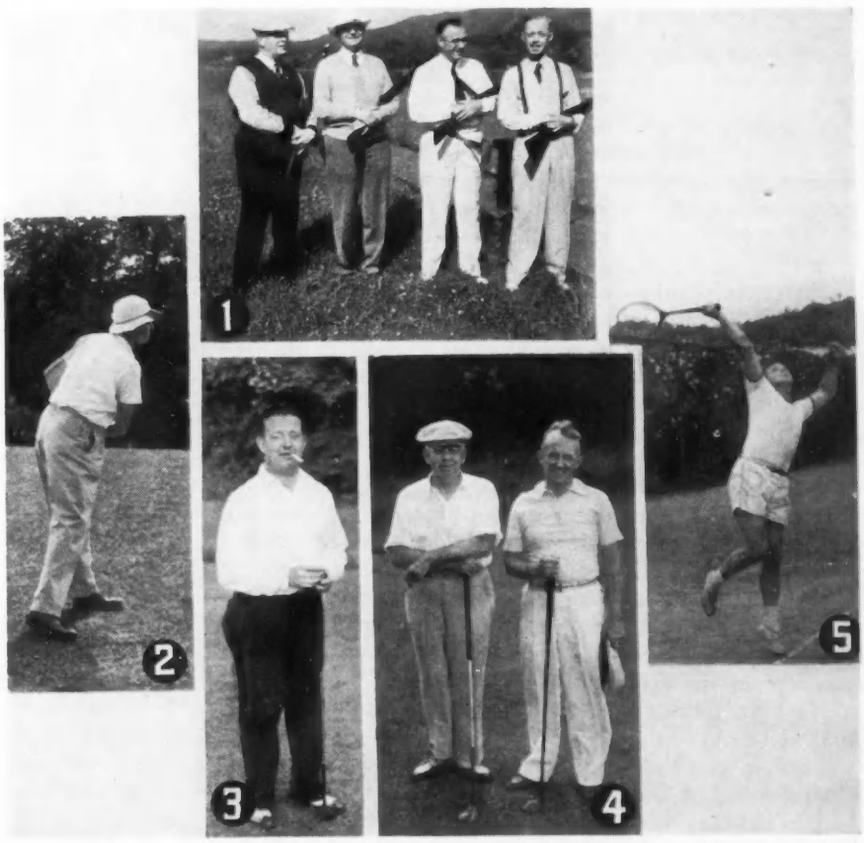
Winner	**– Mrs. W. J. Cumming**	**98**

LADIES' KICKER HANDICAP

Monday	**– Mrs. H. O. Johnson**
Tuesday	**– Mrs. R. E. Cole**
Wednesday	**– Mrs. C. J. Edwards**
Thursday	**– Mrs. R. E. Wilkin**

LADIES' KENO WINNERS

Mrs. G. W. Hobbs
Mrs. Raymond Haskell
Mrs. A. L. Beall
Miss Martha Garland
Mrs. C. A. Michel
Mrs. A. B. Willi
Mrs. Val J. Roper
Mrs. P. S. Tice
Mrs. E. E. Husted
Mrs. W. H. Buderus



1. F. B. Willis, J. G. Vincent, R. E. Cole, L. L. Williams
2. C. E. Dwyer
3. S. C. Merrill
4. F. E. Watts and Harold Nutt
5. S. G. Tilden

Discussion

An unusual hobby was described by W. E. Lerch, consulting engineer, the first to discuss Mr. Heldt's paper. He told how, after a survey of high-speed European automotive Diesels, he had purchased one and installed it in a small car with the object of trying it out under the severe requirements of American roads. The engine that he chose and installed in a small sedan, he specified, was the Oberhansli four-cylinder, 140 cu. in., 55 hp. "So far I have traveled over 5000 miles in the car," he reported, "and I have found quite a number of fuels and lubricants suitable for the job." All present were invited to inspect the car.

Fresh data on the Junkers Jumo 205D two-cycle aircraft Diesel were reported by Rex W. Wadman, *Diesel Progress*. Fuel consumption, he specified, is 0.34 lb. per hp-hr.; specific weight is 1.63 lb. per hp., 2.01 lb. per hp. with cooling; and b.m.e.p. is 105.30 lb. per sq. in.

Improvements in Diesel Engine Lubricating Oils – *Ulric B. Bray, C. C. Moore, Jr., and David R. Merrill, Union Oil Co. of Calif.*

The most striking improvements in lubricating oils for automotive-type Diesel engines have been obtained through the use of soap-type additives, the authors contend, and several brands of this compounded oil are now available to Diesel engine operators. The paper deals particularly with this type of addition agent and reviews the improvements obtained through its use.

Using such an oil, compounded with the calcium soap of dichlorostearate acid, the authors claim that five of the six properties considered necessary for a Diesel-engine crankcase oil are exhibited, namely – detergency which aids in preventing ring-sticking; high film strength which reduces the danger of scuffing, scratching, or galling under severe conditions; a high degree of oiliness which reduces wear under normal operating conditions; low carbon-forming tendency; and adequate crankcase stability which promotes cleanliness of the engine and maintains lubrication efficiency.

With regard to the sixth property – that the oil must be non-corrosive to engine bearings – the paper warns that all of the soap-type compounded oils now on the market are corrosive to the newer alloy-type bearings and, therefore, their use must be restricted to engines equipped with babbitt connecting-rod and main bearings. However, development of an all-purpose non-corrosive compounded oil is expected shortly.

Discussion

A chemical process for treating frictional surfaces called "Feritex" was announced by G. L. Neely, Standard Oil Co. of Calif., in written discussion. The treatment, he explained, consists essentially in dipping machine parts in a chemical bath at a temperature which does not change the heat-treatment or cause distortion of the parts, adding that established manufacturing limits and tolerances are not affected. Among the chief benefits claimed by Mr. Neely for the new treatment are reduction of scuffing and welding during the break-in period; removal of loose particles left in the material during the machining operation; production of a surface film having extreme-pressure properties; production of a blotter-like surface which increases the spreading tendencies of lubricating oils; and reduction of breaking-in time.

"Good enough is not good enough for a Diesel," especially with reference to lubricants, contended C. G. A. Rosen, Caterpillar Tractor Co. The question of using straight mineral oil or compounded lubricants in Diesel engines is primarily a matter of economics, he continued, pointing out the vital importance of maintenance costs to the manufacturer who must live in the field with his equipment. To date some 24 approved lubricants are available to Diesel tractor users, he announced.

Test data that showed significant differences from the results presented by Dr. Bray were displayed by W. G. Ainsley, Sinclair Refining Co. Mr. Ainsley's data compared chlorinated-soap and non-chlorinated-soap lubricants with regard to film strength, wear, and sludging time.

Results of tests on ten street-railway buses that were operated for more than 40,000 miles each were submitted by F. A. Faville, Faville-LeVally Co., to illustrate the concept of oiliness as "that property that results in reduction of wear under normal operating conditions." The same oils were then tested in the Faville-LeVally lubricant tester, he reported, and we found that the test-machine evaluations readily picked out the two oils showing the greatest wear in service.

Both Mr. Neely's and our solution of the problem are fundamentally the same, explained Dr. Bray in summary, only we have followed different paths – we treat surfaces continuously, and Mr. Neely does so at first. We do claim, however, a further decrease in scratching and scuffing over that obtained by surface treatment.

Diesel Oddities – *C. G. A. Rosen, Caterpillar Tractor Co.*

By means of humorous anecdotes garnered from all over the world, the author portrays the curious field conditions encountered in pioneering the Diesel engine for tractor and general construction and industrial uses. Simultaneously he gives an insight into the problems to be solved and difficulties encountered in merchandising and servicing this type of equipment on an international scale. Sandwiched between these "oddities" is considerable practical engineering and operating information.

Automotive Two-Cycle Diesel Engines – *F. G. Shoemaker, General Motors Corp.*

The properly designed two-cycle Diesel is the answer to the problem of building an automotive-type Diesel engine that compares favorably with conventional gasoline engines as to size, weight, and power, Mr. Shoemaker asserts. His paper is chiefly concerned, he announces, with the problem of producing such an engine that will use the same materials, design practices, manufacturing methods, and mechanical parts as are common practice in production-type gasoline engines.

Scavenging is effected in these engines, Mr. Shoemaker explains, by using piston-controlled inlet ports and poppet exhaust valves in the head. To insure thorough scavenging and to obtain additional cylinder cooling, 35 to 45 per cent excess air is used, he reports. He presents test data to show that the power necessary to supply scavenging air is not excessive, and that engine speed is not limited by breathing any more than is the case in the four-cycle engine. He maintains also that, with proper port and valve timing, the power and economy are actually improved by a reasonable back pressure.

The author shows how a change in design of the blower to a three-lobe helical-rotor type reduced noise and improved discharge characteristics. Piston cooling is effected by coring out the rim of the piston between the piston crown and the ring belt and cooling the crown directly by oil spray, he explains, adding that this cooling reduces the ring-belt temperature well below the coking or gumming point of ordinary oils.

Discussing the characteristics of the unit injectors, Mr. Shoemaker shows pressure records that reveal injection pressures of over 25,000 lb. per sq. in. In the remainder of the paper he discusses engine-balance problems and the commercial problems involved in designing the engines and parts to meet a wide variety of applications.

Commemorating the 40th Anniversary of the first American Diesel engine, Harte Cooke, American Locomotive Co., drew from rich personal experience to review Diesel development in those 40 years.

Discussion

Mr. Shoemaker's company has selected the type of two-cycle Diesel engine for development that is most difficult from an engineering viewpoint, opined L. B. Jackson, Fairbanks, Morse & Co., in prepared discussion read by Chairman Rendel. Even so, he continued, it should be successful.

Confirmation of Mr. Shoemaker's finding that the mechanical efficiency of the two-cycle Diesel engine compares favorably with that of the four-cycle engine, was reported by Prof. P. H. Schweitzer, The Pennsylvania State College. The explanation of the good showing of the two-stroke engine, he pointed out, is that it is relieved from the breathing difficulty which is grave with the high-speed four-stroke-cycle engine with tortuous air passages.

Two major problems of the Diesel deserve more attention, contended William F. Joachim, U. S. Naval Engineering Experiment Station:

First, he explained, we must reduce or eliminate the 30 to 50 per cent excess air now necessary by a better mixing of the fuel spray and air in the cylinder. When we can burn

all the air in the cylinder, he contended, we can reduce the weight per horsepower and improve other ratios unfavorable to the Diesel.

The next problem to be solved, he continued, is that of simplifying the fuel injection system. Although conceding that the unit injector as developed by General Motors is a very efficient device, he maintained that all existing injection systems are too complicated and costly. In conclusion, he noted that the General Motors Diesels operate at speeds up to 2800 r.p.m. which, Mr. Joachim pointed out, is the limit of efficient breathing capacity using poppet valves.

Taking issue with Mr. Joachim, Mr. Shoemaker contended that excess air is essential and that the inherent economy of the Diesel engine depends on it. As to claims of complication and excessive cost of injection equipment, he submitted that all parts are conventional automotive parts. Speaking of fuels, he explained that the engines will run on any fuel from 39 cetane number up. We point out to the customer what he may expect in performance and maintenance from various types of fuels and let him take his choice, he said.

Detonation Symposium

W. M. Holaday, *chairman*

A well-organized assault on the unsatisfactory correlation obtained hitherto between laboratory and road knock ratings was launched in this five-paper symposium. Present methods were attacked and defended; two new methods for making road ratings were introduced; a statistical approach to the problem was urged as an aid to individual judgment; and the many variables that complicate the problem were scrutinized separately.

Correlation of Road and Laboratory Octane Numbers – *J. R. Sabina, Chairman, C.F.R. Correlation Group.*

No change in the method for correlating road and laboratory ratings is recommended, this report concludes. The failure to achieve better correlation, it explains, is not due primarily to shortcomings of the data, but to the failure to take cognizance of all the factors influencing car ratings. Furthermore, it reports, no material improvement can be expected from accumulation of additional laboratory data involving only speed, temperature, and spark advance.

At the November, 1936, meeting of the Cooperative Fuel Research Committee the study of the correlation between laboratory knock ratings and road ratings in the then-current automobiles was authorized. The outcome of a preliminary study, based on information submitted by individual companies in 1934, 1935, and 1936 cars, indicated the desirability of collecting cooperatively road and laboratory data under controlled conditions for a more accurate evaluation of the correlation problem. The results of the work of the Road-Test Analyzing Group and the Laboratory Group already have been presented. This report presents the findings of the correlation group.

Evaluation of the various laboratory methods, from the standpoint of correlation, is based on:

1. The deviations of the average laboratory ratings from the road ratings.
2. The deviations of the average laboratory ratings from a 45-deg. line displaced from the origin to give the lowest average deviation.

A critical examination of the road ratings resulted in basing correlation on the average of road ratings at spark advances not in excess of 10 deg. over the manufacturers' specifications for initial spark timing.

A Practical Approach to the Road Detonation Problem – *A. J. Blackwood, C. B. Kass, and G. H. B. Davis, Standard Oil Development Co.*

Present methods of correlating road knock behavior of fuels with laboratory methods are unsatisfactory and should be discarded in favor of a method that makes a new approach to the problem, the authors contend. Reviewing the causes of this situation, the paper offers evidence to show that the use of mathematical averages applied to the study of the car detonation problem has been very misleading and that the so-called average fuel octane-number requirement of existing cars and its corollary, the octane requirement of the average car, are values having little practical significance.

A procedure is recommended by the authors as one approach to the problem of setting up a simple, practical way of evaluating fuels. It consists in selecting a number of privately owned cars and testing both reference-fuel blends and branded fuels in these cars without making any changes whatsoever in the engine adjustments. If the cars selected constitute a representative cross-section of the total cars on the road, the authors explain, the results obtained should then be representative of actual service conditions. The results of two such surveys are reported.

Application of Statistical Concepts to the Knock-Rating Problem – *John M. Campbell and W. G. Lovell, Research Laboratories Division, General Motors Corp.*

Conclusive evidence that any one make of car has a real, as distinguished from accidental, tendency to rate fuels higher or lower than the average for all cars is difficult to find in existing data, the authors report.

The growing economic and technical importance of antiknock quality, they point out, is making it increasingly desirable to estimate the random distribution of errors that occur in making measurements of knock, either in the laboratory or in road tests. Statistical analysis, they explain, offers a means of appraising the probability of occurrence of errors of various magnitudes. However, the authors qualify, it is offered as an aid to individual judgment, not as a substitute for it. To make a beginning in such a statistical analysis of the available data on fuel ratings is the purpose of their paper, they announce.

The variability, or random error, among successive measurements in road tests was from three to six times higher than the variability among measurements of octane number in the A.S.T.M.-C.F.R. single-cylinder test engine, the paper reports. Also, the variability among ratings made in different makes of cars was only slightly greater than the variability among repeated tests in a single car of one make.

The high variability in road ratings also makes it necessary to obtain a relatively large number of road ratings on any particular gasoline before a reliable comparison can be made between it and other gasolines with the same degree of precision that is obtained in the mean of three or four laboratory ratings on each fuel, the paper concludes.

Spark Advance and Octane Number – A Road-Test Technique – *W. E. Drinkard and J. B. Macauley, Jr., Chrysler Corp.*

The road-test technique outlined in this paper, the authors explain, was developed to find a method that would give a broader picture of the car-fuel relationship. Although conceding that the general method employed – using the knock die-out point as a datum in the study of fuels in road cars – is not new, they claim that their technique increases the speed and precision in the method of obtaining borderline advance, and offers data over a wider field than hitherto presented.

A fully manually controlled distributor, a spark-advance indicator, and thermocouples for indicating the necessary operating temperatures comprise the apparatus used, the paper reports. The authors suggest that a more accurate and dead-beat means of indicating car speed than the car speedometer be employed, such as a fifth-wheel electric tachometer.

The general procedure consists in accelerating the car in high gear from approximately 10 m.p.h. and noting the speed and the spark advance at which audible knock disappears, thus locating one point on the curve. The spark advance is then altered by about 2 deg. and the acceleration repeated to locate another point, and so on until enough points are located to complete the curve.

The paper follows with notes on testing; correlation of borderline knock data with data obtained on a knock-intensity basis; a discussion of octane requirement and road rating of fuels; and concludes by pointing out the usefulness of this technique in evaluating car variables.

Knock-Testing in the Laboratory and in Service – *Graham Edgar, Ethyl Gasoline Corp.*

An exact correlation between laboratory methods of knock-testing and service results is hardly to be expected on theoretical grounds, believes Dr. Edgar. And the problem of "average road knock-ratings" calls loudly for statistical study, he contends, pointing out that no really sound statistical basis has been worked out. Because of the extraordinary complexity of the problem both in the laboratory and in service, he shows that much uncertainty attends the interpretation of any individual service knock test and that the spread of results from engine to engine is so wide that any type of *average* figure bears little relation to the results which may be expected in an individual engine, or to the impressions of any individual driver.

The paper discusses the problem broadly, attempting to point out what is possible to achieve in the solution of the problem and what is not possible. The author explains that the automobile and the airplane are considered separately as each presents a different problem.

Discussion

"The gasoline marketer is not so much interested in the octane requirement for which a car is designed, as he is in what the requirement is after the car is in the hands of the

customer," pointed out John O. Eisinger, Standard Oil Co. of Ind., in prepared discussion referring to the method outlined in the paper read by Mr. Blackwood. Using data obtained from a survey of 70 privately owned cars during the summer of 1936 and comparing them with similar data collected by the Standard Oil Development Co., and the C.F.R. and A.P.I., Mr. Eisinger pointed out the discrepancies which may exist among the knock-intensity interpretations of different laboratories.

"We wish to endorse the authors' statement that any cooperative work of this kind among independent laboratories would necessitate standardization of knock intensity, and that standardization of the nomenclature (trace, light, medium, and so on) is probably the first step that must be taken," he declared.

The standard deviation of 1.2 octane numbers for repeated ratings of *one fuel in the same car* suggests the need for more rigid supervision and control of road-test methods, Mr. Eisinger pointed out in prepared discussion of Messrs. Campbell and Lovell's paper. In this respect, he continued, the road work of the C.F.R. and A.P.I. this year as currently outlined, calling for more uniform and controlled test technique, certainly is a step in the right direction.

Taking issue with the statement in the paper by Messrs. Drinkard and Macauley which questioned the practical value of any average or statistical survey of car octane requirement, Mr. Eisinger contended that it fails to recognize that there is considerable difference between the viewpoints of the automotive and oil industries as to what represents the most desirable octane-requirement information. Accordingly, he explained, the automotive industry is interested primarily in the octane number of new cars, whereas the oil industry's concern is with *all* cars that drive into their service stations.

Rising in defense of the value of the cooperative and committee work done in knock-test correlation, Mr. Eisinger commented on Dr. Edgar's paper as follows:

"After reading Dr. Edgar's paper, one is tempted to conclude that a satisfactory solution to the problem is more remote today than ever before despite the tremendous amount of independent and cooperative test work which has been completed since 1932. The work that has been done has brought to light all the factors mentioned by the author, some indeed which he fails to mention. At the same time these investigations have contributed much to the understanding of these factors, indicating those which merit adjustments and those which should be neglected as unimportant. Dr. Edgar is not alone in his realization that no laboratory knock-test method can be developed which will reflect service performance *perfectly*. On the other hand, the problem of developing a laboratory method which will give knock ratings in *substantial* agreement with road knock determinations is far less confusing and, we feel, much nearer solution than the author intimates."

To illustrate the difficulty of determining the actual spark advance of cars on the road, J. R. MacGregor, Standard Oil Co. of Calif., showed curves that indicated the spread of spark advance, at various speeds, among cars with different initial spark settings and illustrated the wide variation in spark settings as cars get older. He described briefly the spark-advance indicator, which he announced in a paper which he presented at the 1937 Summer Meeting, as an instantaneous method of determining the spark advance of a car on the road.

Although agreeing with Mr. Blackwood on the necessity for correcting for the sensitivity of the fuel, T. B. Rendel, Shell Petroleum Corp., cautioned that "we still don't know how to measure sensitivity." We have found the borderline-knock curves used by Messrs. Macauley and Drinkard very useful in running tests, he reported. Bear in mind loss in horsepower when interpreting deviations in spark timing, he recommended, using curves showing the relationship between spark advance and horsepower loss to illustrate his point.

T & M Electrical Equipment Session

F. L. Faulkner, *chairman*

Attention accorded to Mr. Critchfield's paper indicated that T & M men are very much concerned about the electrical equipment of the trucks they operate, and their spontaneous discussion brought to light many of the problems they have faced, as well as some solutions.

Mr. Critchfield said that much of the information included in his paper was based upon the result of a questionnaire sent out by Capt. Oscar A. Axelson, chairman of the T & M Activity's meetings committee, his company's field service engineers, and on information given to him by several operators of large fleets.

Effect of Proper Application on Maintenance of Automotive Electrical Equipment – *R. M. Critchfield, Delco-Remy Division, General Motors Corp.*

Mr. Critchfield attacks the problem of securing automotive electrical equipment that will operate satisfactorily at the lowest original as well as upkeep cost.

Integral parts of the electrical supply system, the ignition system and the cranking system are discussed with notes on maintenance of each. Particular attention is given to the various items which affect the sizes and types of equipment necessary. Mr. Critchfield points out that misapplications from both the capacity and operation standpoints are often the source of the most serious maintenance problems, and he gives specific examples to illustrate.

In the tables accompanying the paper the author presents application charts to serve as a rough guide in considering the purchase of new equipment.

Discussion

Session Chairman Faulkner's call for discussion was promptly answered by M. C. Horine of Mack, who was anxious to congratulate Mr. Critchfield for presenting "a virtual compendium of information." Mr. Horine had prepared discussion in which he asked the author why we cannot have generators which can be geared properly with regard to maximum speed and then have the cut-in adjusted to meet requirements.

In response Mr. Critchfield gave two reasons – first, the desire of manufacturers to keep the number of generator windings to a minimum in order to simplify service and maintenance problems, and second, because in some high-output units armature turns are down to such a low number that reducing the number of turns would make too radical a change in low-speed performance. In other words, he said, with a two-turn armature a decrease of one turn would reduce low-speed performance 50 per cent.

Mr. Horine also suggested that it would be good practice to inclose primary wires, for lights, etc., in a metal conduit to protect them from abrasion, water, oil, oxidation of insulation and from fire should the wires become overheated because of overload or shorting. Mr. Critchfield agreed that this would be satisfactory if properly done, but noted that the expense would be too great for most installations. Another point brought out by Mr. Horine is that there has been difficulty with ignition cables inclosed in metal that has been relieved by substituting an open harness. He asked if it is not true that metal inclosures tend to collect moisture and leak off considerable energy by grounding.

The author agreed that it is preferable to leave high-tension

cables open. However, he said, some installations require shielding to avoid a tendency to cross-fire. He added that shields can be arranged to permit ventilation.

Dr. Felix L. Yerzley, of duPont, spoke of synthetic materials available for insulation which have advantages over natural rubber in that they better resist heat, moisture and oil, and in that they are also non-inflammable. Mr. Critchfield pointed out that many of these synthetic materials do not insulate as well as rubber, and that combinations have been worked out consisting of rubber protected by synthetic materials.

The necessity of keeping electrical equipment free from dirt and moisture was emphasized by P. J. Kent of Chrysler.

Mr. Kent also stressed the importance of providing a generator mounting which will prevent high-frequency vibrations which are apt to cause brush wear.

F. K. Glynn, American Telephone & Telegraph, called attention to his findings that when a voltage regulator is selected for a given generator the results are much "sweeter" than when the two units are not matched.

In answer to a question from Mr. Smith, also of A.T.&T., Mr. Critchfield stated that present regulator equipment is temperature compensated so that no change of adjustment is required to take care of summer or winter driving conditions. He likewise noted that it is not necessary to recognize temperature on vehicles which operate continuously – adding that temperature is much more of a worry in passenger cars and other vehicles which are permitted to get cold between starts on winter days.

Replying to a question from Chairman Faulkner, Mr. Critchfield said of purchase specifications for coils, that certain specifications would eliminate coils fundamentally wrong, but that coils probably fall in the classification of some other products of the industry which require acceptance tests before final approval.

Motor Gasoline Volatility Conference

S. W. Sparrow, *chairman*

Mr. Sparrow, the chairman, stated that this meeting was called for informal discussion of the matter of a fuel volatility index. It is appreciated, he said, that both technical and economic factors are involved, and expressed the hope that the meeting might serve to develop more attention to the subject and possibly indicate a trend of later action.

The particular occasion of this meeting, I think, is to discuss the advisability of some sort of fuel volatility rating or identification, explained F. C. Mock, Bendix Products Corp. The call for this rating, he continued, seems to come from at least three groups, for different reasons, and it involves cooperation with different groups.

Speaking first for the motor-car user, Mr. Mock pointed out that a number of these people have cars which represent a considerable investment and which are inoperative at certain seasons of the year on fuel which they might buy at a large percentage of the filling stations. These people need, and need badly, some way by which they can find a filling station in a strange town where they can procure fuel that will not "lock them up" at speeds over 50 m.p.h., he declared; they even need to know how to tell from which pump to buy fuel in a given filling station. This is a request that the motor car user is making from the gasoline industry, he explained.

Next, Mr. Mock continued, we in the motor-car industry are requesting a forecast from the oil industry as to the probable volatility trend of fuels in the next two or three years ahead so that we can direct our work accordingly. The Bureau of Mines Surveys and what we can learn of present development indicate a trend toward slightly higher volatility, but I would appreciate an expression from the meeting on this point, he urged.

Finally, I would like to record a request from the carburetor builder who must fit automatic chokes and acceleration pumps, and also on behalf of the product engineer in the motor-car factory engineering department who is responsible for fitting the hot-spot heat-control valves, that a standard of volatility in winter and summer gasolines be agreed upon, so that he will know how to make the best available compromise, Mr. Mock stated. I want to point out here, he explained, that the two automatic devices, the automatic choke and thermally controlled heat valve, are subject only to fuel variation since they are adjusted for temperature, whereas vapor lock is much more serious in that it can be obtained both by fuel variation and temperature variation. All the automatic chokes are adjustable for the different fuels, he continued, though the adjustment is not plainly marked; but, after the driver has had his adjustment made for a given gasoline, at the present time there is no way that he can go to another filling station and buy a new tank-full of gasoline that will fit the automatic choke adjustment that he has just had made. On the other hand, he added, if the poor driver is threatened with vapor-lock trouble, there is no adjustment that he can make to allow him to drive if the fuel volatility is too high for the temperature under his hood.

The problem of automatic choke and heat-valve setting is not particularly serious, Mr. Mock reported; it only requires mutual understanding. To illustrate the situation, he said, I would like to describe the result obtained late last February in driving a car with summer fuel. This result was with a carburetor and heat-valve setting that had given entirely satisfactory operation the previous summer on summer fuels and had been similarly satisfactory through the winter on winter fuels, he explained. The atmosphere during the few days of this particular trial varied from about 28 to 40 deg. fahr., he reported. After standing out-of-doors for several hours, the car (with the summer gasoline) would start readily and drive away for the first mile in perfectly satisfactory fashion, he related; then, after the automatic choke had practically released itself, you could scarcely drive the car. The mixture ratio was, in effect, too lean for continuous driving up a slight grade, and the accelerating pump charge was much too small, so that the engine would die away as the throttle was opened. I noted also, he recalled, that the heat valve on the intake manifold hot-spot was practically wide open and that the intake manifold was barely luke warm. Any test driver or service man would have unhesitatingly declared that the carburetor choke and heat valve settings were way wrong, he contended.

Then, Mr. Mock went on, after driving a mile or so under this condition, the temperature under the hood gradually rose and the operation became all right again; both steady running and acceleration were perfect and it was almost unbelievable that a short time before the operation had been so bad. Tests on successive days with different observers checked the first observations. Starting from a warm garage or after standing a half hour, the duration of the objectionable operation was short and sometimes would not be noticed, he reported. It is certain, however, that the ordinary driver would have been very much dissatisfied with the standard of performance, he pointed out.

In dealing with this situation, Mr. Mock reasoned, the first requirement would seem to be that the automobile companies

and gasoline companies should have a mutual agreement as to what would be a fair standard of volatility of summer and winter gasolines so that, in making carburetor and engineering specifications, a reasonable average might be arrived at in performance standards. Such standards, he explained, will depend both upon the operating requirements of the automobiles and upon the fuel elements available to the gasoline companies and will merit considerable discussion at this meeting.

Another question of immediate importance, Mr. Mock pointed out, is how shall these standards be determined and specified? We know that vapor pressure alone will not be satisfactory since it depends too largely upon the volatility of the lighter elements present without regard to their proportion in the blend, he explained. There is some question, he continued, whether either the 50 per cent distillation point or an average between the upper and lower ends would be a satisfactory index. It would seem that the equilibrium distillation curve should be the criterion, he suggested, since what we are concerned with is the percentage of fuel which will vaporize under the given operating conditions but, for various reasons, this criterion does not seem suitable for general use – at least it has not been generally adopted so far. This is also a division of the subject worthy of discussion, he said.

It has been proposed that gasolines be rated both from the volatility standpoint and from the octane index so that a customer might learn to select the gasoline that his car requires according to the season of the year and his past experience, he reported. Unfortunately this method seems to offer many difficulties, he pointed out; for instance, there would be a demand for high octane rating fuels with both high and low volatility, and vice versa. I believe, he suggested, that we could make some immediate progress if we can begin by selecting nominal standards, or test standards, for summer and winter fuels, without saying how much variation from such standard makes a fuel either good or bad. After this we can develop such other steps as are indicated by further experience, Mr. Mock concluded.

Neil MacCoull, The Texas Co., pointed out that the requirements of starting at low temperatures were practically the same for all cars as regards high fuel volatility, but that a tendency to vapor-lock after starting narrowed the permissible volatility range; for instance, there were some cars that were rather apt to vapor-lock after high-speed driving at 50 deg. fahr., on any fuel that would start them at 20 deg. fahr. Mr. MacCoull also stated that, in their observation, they had found that cars of different makes vary as much as 50 deg. fahr. in under-hood temperature on the same day.

John O. Eisinger, Standard Oil Co. of Ind., mentioned a number of tests made by his company with a variety of fuels with greater volatility range than those mentioned by Mr. Mock and stated that starting had been quite satisfactory with all of them with automatic chokes, but not so good with manual chokes. As a measure of general operating volatility, he recommended a rating based on a combination of the 30 per cent and 90 per cent distillation points.

A. L. Clayden, Sun Oil Co., pointed out that there are more cars on the road without automatic chokes than those with them. He also remarked that cars in the last few years seemed, in his observation, to have a greater tendency to vapor-lock than older ones. He suggested that vapor-lock might be reduced by taking cool air supply to the air cleaner and carburetor.

A. G. Marshall, Shell Oil Co., said that he did not expect much change in volatility in the next few years.

J. R. MacGregor, Standard Oil Co. of Calif., said that, although he did not expect much change, they had had to change their fuel specifications at least once each of the last three years.

R. C. Alden, Phillips Petroleum Co., stated that each of the important steps in increasing octane rating seemed to be accompanied by a rise in volatility and that he believed that this was a definite trend which the advance work should take into account.

J. B. Macauley, Jr., Chrysler Corp., approved what Mr. Alden had said and stated that, in the work of his company, they had assumed that the 10 per cent distillation point was the measure of starting ability, whereas the 40 per cent and 60 per cent range was indicative of warming-up performance.

John M. Campbell, General Motors Corp., added his request for an index of gasoline volatility and emphasized the point that vapor lock, to an extent that the car would not run, occurred almost entirely at the fuel pump, and that the measure of this action was the per cent of the fuel that would vaporize at the given operating temperature. He reported that he is working on and had brought to the meeting for demonstration a car equipped for measurement of vapor-locking characteristics with different fuel blends, the remainder of the test procedure involving determination of the V/L (vapor volume/liquid volume) of the same fuel blends at different temperatures.

All present agreed on the importance of the problem and thought that something might be done later.

Lubricants Session

B. E. Sibley, *chairman*

There was no last-of-meeting inertia when lubricants men met at Friday morning's wind-up session. Chairman Sibley had so many volunteers when he called for discussion that he was obliged to permit the session to continue past the scheduled closing time. Each paper was discussed separately.

Safe Viscosity for a Motor Car Engine Lubricant – *Stanwood W. Sparrow, Studebaker Corp.*

Mr. Sparrow's paper emphasizes the importance of the question, "What is the minimum safe viscosity for an engine oil?"

While he does not attempt to solve the problem he presents material "accumulated as a by-product of routine engine tests and development" which, he says, indicates that rather low viscosities may be safe for bearings if and when we can be sure that the amount of lubricant which reaches the bearings will be adequate. He adds that it also indicates the extent to which safe lubrication of the cylinder bores depends upon the ability to produce and maintain smooth surfaces on pistons, piston rings and cylinder walls.

He illustrates how a low viscosity is effective in increasing cranking speed and in reducing friction – thereby producing a gain in horsepower and fuel economy. He also cites examples to show the extent to which low viscosity is detrimental as regards oil consumption, blowby and the protection which the oil film affords to the rubbing surfaces.

Finally, Mr. Sparrow discusses in some detail the effect of changes in viscosity upon the lubrication of pistons, piston rings, cylinder walls and main and connecting-rod bearings.

Lubrication of Special Running Gear Mechanism – *Joseph Geschelin, Automotive Industries*

The possibility and desirability of standardizing perhaps three basic chassis lubricants – a range of motor oils, a range of mild extreme-pressure lubricants, and a specially graded hypoid-gear lubricant which can be readily differentiated from the mild or chemically-stable E.P. materials, is pointed out by the author, who recently completed a comprehensive survey of factory-approved or recommended lubricants for special running-gear units, such as over-drives, automatic transmissions, two-speed axles for cars and trucks, and truck transmissions.

He reports that truck transmissions and rear axles, in particular, and certain other units of special design, generally have no requirements for lubricants possessing special film strength. Heavy-duty truck and bus service, he emphasizes, does demand highly refined mineral oils of proper viscosity, possessing chemical stability – freedom from sludging and oxidation.

(*Concluded on page* 50)

New Members Qualified

These applicants who have qualified for admission to the Society have been welcomed into membership between May 15, 1938, and June 15, 1938.

The various grades of membership are indicated by: (M) Member; (A) Associate Member; (J) Junior; (Aff.) Affiliate Member; (SM) Service Member; (FM) Foreign Member.

Baltimore Section

MARTIN, RALPH V. (A) lubrication engineer, American Oil Co., American Bldg., Baltimore, Md. (mail) 115 E. McIntyre Ave., N.S., Pittsburgh, Pa.

RYAN, WILLIAM JOSEPH, JR. (J) automotive engineer, Ethyl Gasoline Corp., 1102 Court Square Bldg., Baltimore, Md.

Buffalo Section

HOWE, WINTHROP K. (M) chief engineer, General Railway Signal Co., Rochester, N. Y.

Canadian Section

PETERS, ABRAM (A) assistant superintendent, National Motors, Ltd., 945 Bay St., Toronto, Ont. (mail) 299 Glenholme Ave.

Chicago Section

LYNCH, RAYMOND J. (M) engineer, New Departure Co., 230 N. Michigan Ave., Chicago.

ROURKE, BRANDON E. (A) editor, Shaw Publishing Co., 624 S. Michigan Ave., Chicago.

TEMPLE, ROBERT J. (A) transportation manager, Lincoln-Boyle Ice Co., 4628 Greenview Ave., Chicago. (mail) 538 Roscoe St.

Cleveland Section

BORCHIK, ALBERT S. (A) garage foreman, Ohio Bell Telephone Co., 750 Huron Road, Cleveland (mail) 19341 S. Sagamore Road, Fairview Village, Ohio.

ENGEMANN, HERBERT H. (M) experimental engineer, Thompson Products, Inc., 2196 Clarkwood Road, Cleveland (mail) 3505 Edison Road, Cleveland Heights, Ohio.

HASSEL, ALOYSIUS N. (A) shop foreman, Bailey-Buick Co., 14400 Detroit Ave., Lakewood, Ohio (mail) Nagel Road, Avon, Ohio.

SIEGLING, ELMER (M) engineer, Thompson Products, Inc., 2196 Clarkwood Road, Cleveland (mail) 2488 Fenwick Road.

Dayton Section

YOUNG, GERALD P. (M) aeronautical representative, Röhm & Haas Co., Inc., 222 W. Washington Square, Philadelphia (mail) 6030 N. Main St., Dayton, Ohio.

Detroit Section

ROSSMAN, DURWARD E. (M) Ethyl Gasoline Corp., 723 E. Milwaukee Ave., Detroit.

SIBLEY, BRACE H. (M) engineering department, Champion Spark Plug Co., Toledo, Ohio (mail) 4530 Belmar Ave.

SWIGERT, ARTHUR MELVILLE, JR. (M) production research, Chrysler Corp., Jefferson Plant, Detroit (mail) 5106 Buckingham.

Metropolitan Section

FRENCH, HARRY B. (A) combustion sales engineer, Gulf Oil Corp., 17 Battery Place, New York (mail) 2875 Sedgwick Ave.

GRUMME, FRED J. (J) eastern maintenance superintendent, Aero Mayflower Transit Co., 915 Daly St., Indianapolis, Ind. (mail) 676 Chancellor Ave., Irvington, N. J.

LEWIS, OLIVER GRIFFITH (J) research engineer, Standard Oil Development Co., Elizabeth, N. J. (mail) 321 Elmora Ave.

SCHIPPER, JOHN EDWARD, JR. (J) associate editor, Hearst Magazines, Inc., New York (mail) P. O. Box 515, Pleasantville, N. Y.

WOODBURN, MELVERN C. (A) prestone specialist, National Carbon Co., 30 E. 42nd St., New York (mail) 83-14 St. James St., Elmhurst, L. I., N. Y.

Northwest Section

THOMAS, SAM (A) vice-president, Peter Thomas & Co., 14th South & Main St., Seattle, Wash. (mail) 1320 Main St.

Northern California Section

FORREST, FRANK D. (M) research engineer, Standard Oil Co. of California, Richmond, Calif.

Philadelphia Section

SCHROEFFEL, JOHN B. (M) automotive engineer, Socony-Vacuum Oil Co., Inc., 58th & Schuylkill River, Philadelphia (mail) 703 Germantown Manor, Green & Hortter Sts.

SCHULZ, BUFORD F. (J) charge, truck maintenance, Delaware Coca Cola Bottling Co., 100 Gray Ave., Wilmington, Del. (mail) 1000 W. Ninth St.

Southern California Section

ROWLEY, ROBERT E. (M) office engineer, general plant division, City of Los Angeles, Dept. of Water & Power, 207 S. Broadway, Los Angeles (mail) 933 N. Geneva St., Glendale, Calif.

Syracuse Section

DODGE, RALPH L. (M) chief engineer, New Process Gear Corp., 500 Plum St., Syracuse, N. Y. (mail) 219 Plymouth Drive.

Washington Section

ROOP, FRANK S., JR. (J) instructor, mechanical engineering, charge of mechanical laboratory, Virginia Polytechnic Inst., Blacksburg, Va. (mail) Box 256.

SCHOENBAUM, GEORGE H. (A) Standard Oil Co. of N. J., 26 Broadway, New York. (mail) 261 Constitution Ave., N.W., Washington, D. C.

Wichita Club

HARDEE, SAM W. (A) vice-president, Universal Motor Oils Co., 317-321 N. Wichita St., Wichita, Kan.

Outside of Section Territory

PLOEHN, JOHN H. (M) works manager, French & Hecht, Inc., Third & Farnam Sts., Davenport, Iowa.

STITT, WILLIAM T. (J) junior maintenance engineer, Pan American Airways System, Western Division, Brownsville, Texas. (mail) Route 1.

WACHS, MILLER ALLEN (J) analytical engineer, Aviation Mfg. Corp., Lycoming Division, Williamsport, Pa. (mail) 722 Arch St.

Foreign

BERTHELIUS, TOR (J) civil engineer, Aktiebolaget Volvo, Pentaverken, Skovde, Sweden.

RIX, JOHN ROBERT (FM) automotive designer, Austin Motor Co., Ltd., Birmingham, England. (mail) "Wynyates" Cofton Church Lane, Barnt-Green.

SYKES, ARTHUR (FM) director, David Brown & Sons (Hudd) Ltd., Park Works, Lockwood, Huddersfield, Yorks, England.

Applications Received

The applications for membership received between May 15, 1938, and June 15, 1938, are listed herewith. The members of the Society are urged to send any pertinent information with regard to those listed which the Council should have for consideration prior to their election. It is requested that such communications from members be sent promptly.

Baltimore Section

TAYLOR, J. MALLORY, JR., president, Ditch, Bowers and Taylor, Inc., Baltimore, Md.

Canadian Section

GILLESPIE, ROBERT GEORGE, Department Engineer, Toronto Transportation Commission, Toronto, Ont.

RIVARD, THOMAS, school principal, Mountjoy School Board No. 3, Timmins, Ont.

SMITH, JOHN GODFREY, president, Federal Wire & Cable Co., Ltd., Guelph, Ont.

SMITH, THOMAS MCKENZIE, purchasing agent and supervisor fleet operation, Supertest Petroleum Corp., Ltd., Supertest Building, London, Ont.

Chicago Section

REED, J. HOWARD, salesman, Bendix Products Corp., South Bend, Ind.

Cleveland Section

EVANS, R. D., tire design, Goodyear Tire & Rubber Co., Akron.

FLEMING, HERMAN VINCENT, engineering sales, Timken Roller Bearing Co., Canton, Ohio.

KENNEDY, W. MURRAY, engine design engineer, White Motor Co., Cleveland.

Dayton Section

VAN DERMARK, FRED J., 808 Sycamore St., Cincinnati.

ZERBO, JOHN D., cost accountant, traffic and service manager, Strietmann Biscuit Co., Cincinnati.

Detroit Section

MACDONALD, CHARLES E., junior engineer, Chrysler Corp., Highland Park, Mich.

STRAUB, PAUL F., JR., junior engineer, Chrysler Corp., Detroit.

STONE, DONALD D., research engineer, Willys Overland, Toledo, Ohio.

TASKER, EDWIN MURRAY, vice-president, charge of sales, Toledo Stamping & Mfg. Co., Toledo, Ohio.

Metropolitan Section

BELL, O. DWIGHT, 2237 Grand Ave., New York.

BRAUNSDORFF, R. K., lamp engineers, Tung Sol Lamp Works, Inc., Newark, N. J.

BRITTON, JOHN A., sales manager, Standard Oil Development Co., New York.

DAMON, NORMAN, director, Automotive Safety Foundation, New York.

DONOHUE, GUY B., automotive engineer, Ethyl Gasoline Corp., New York.

ELBRECHT, ROBERT J., designer, Elbrecht Engineering Co., Newark, N. J.

FISHER, DAVID A., tutor, School of Technology, College of City of New York, New York.

WENK, CHARLES S., owner and general manager, Charles S. Wenk, Elizabeth, N. J.

Milwaukee Section

CHAPMAN, HENRY C., sales engineer, Stolper Steel Products Corp., Wauwatosa, Wis.

Northern California Section

KADOW, WALTER W., service manager, White Motor Co., San Francisco.

(*Continued on page* 47)

About SAE Members:

Lieut. H. Knox Perrill, engineering officer, United States Navy, has been made superintendent of the aeronautical engine laboratory at the Naval Aircraft Factory, Philadelphia, where he has been engaged in experimental work on aircraft engines since early this year.

Harold W. Kost, president of Prestole Devices, Inc., which has recently been acquired

H. W. Kost
Heads Harvester Division

by the Detroit Harvester Co., now heads Harvester's Prestole Division.

Capt. Edward V. Rickenbacker received the honorary degree of Doctor of Aeronautical Science at the Commencement of Pennsylvania Military College, June 7.

Harry W. Holt, vice-president and sales manager of Bohn Aluminum & Brass Corp., has resigned as an active executive of that company. He continues as a director.

Hyman Bornstein, director, testing and research laboratories, Deere & Co., and retiring president of the American Foundrymen's Association, has been elected a director of the Association for a three-year term. *F. A. Lorenz, Jr.,* vice-president, American Steel Foundries, has also been elected a director of the A.F.A. for a like period.

Robert Callow, Jr., formerly a student at the Polytechnic College of Engineering, Oakland, Calif., is junior engineer doing drafting and design work in the general construction department of the Pacific Gas & Electric Co., San Francisco, Calif.

Paul L. Francois has been named assistant sales manager of the R. M. Hollingshead Corp.

Howe H. Hopkins, formerly district service representative for the Chrysler Corp., has joined the Sun Oil Co. as field engineer in Boston, Mass.

John L. Coltman, Nasmyth, Wilson & Co., Ltd., England, has been invited by the Institution of Mechanical Engineers to give the annual lecture for the next season before the graduates' section of the Manchester branch of the Institution. Mr. Coltman recently was promoted to the grade of associate member of the Institution.

A.M.A. Elects

Alvan Macauley, president of the Packard Motor Car Co., was elected president of the Automobile Manufacturers Association for the eleventh time at the Association's annual meeting in Detroit, June 9. *Alfred P. Sloan, Jr.,* was re-elected vice-president, *Byron C. Foy,* secretary and *Alfred Reeves,* vice-president and general manager. SAE members serving on the board of directors include: *Mr. Macauley, Mr. Sloan, Mr. Foy, Walter P. Chrysler, Paul G. Hoffman,* and *William S. Knudsen.*

Thanks—

From the SAE JOURNAL to **J. C. Geniesse** of Atlantic Refining for the extensive book review of the 3192-page "Science of Petroleum" which appeared on p. 31 of the June issue. Several appreciative comments have already been received since its publication.

John Wilkinson, a charter member of the Technology Club of Syracuse, has been awarded one of the Club's few honorary memberships. Mr. Wilkinson is a founder member of the SAE and served as one of its first officers.

Leonard Ochtman, Jr., has joined the Curtis Manufacturing Co., St. Louis, as assistant to the chairman of the board, an engineering position. His previous connection was that of mechanical engineer, in charge of the development of the Dresser gas engine and compressor, with the S. R. Dresser Manufacturing Co., Bradford, Pa.

Arthur H. Timmerman, vice-president in charge of engineering and manufacturing, Wagner Electric Corp., recently was elected first vice-president of the National Metal Trades Association.

W. R. Spiller
To Timken-Detroit

W. R. Spiller has become affiliated with the Timken-Detroit Axle Co., Detroit, in the capacity of special engineer. He was previously chief engineer of the White Motor Co., Cleveland, with which he had been associated for 15 years in various engineering capacities.

O. P. Liebreich is power brake engineer in the power brake division of the New Britain Machine Co., New Britain, Conn. Prior to taking this position he was sales engineer with the Rockwell Products Co., Hartford, Conn.

Charles Stewart Mott, vice-president of General Motors Corp., was elected a member of the board of trustees of the Stevens Institute of Technology at the pre-commencement meeting of the board on June 9. Mr. Mott graduated from Stevens with the class of '97, and last year received an honorary degree of Doctor of Engineering, on the fortieth anniversary of his graduation.

Peter Altman, director, aeronautical engineering department, University of Detroit, and a past-chairman of the Detroit Section of the Society, is author of "History of Aviation in the State of Michigan," recently published by the State of Michigan Historical Commission.

A. A. Lane, Gulf Research & Development Co., and *T. H. Risk,* the Pure Oil Co., have been added to the membership of the Cooperative Fuels Research Automotive Diesel Fuels Division.

V. P. Rumely, past-chairman of the Detroit Section, who joined the Crane Co., Chicago, about a year ago, has been appointed works manager of that company.

Prescott C. Ritchie, advertising manager, Waukesha Motor Co., has been elected vice-president of the Milwaukee Association of Industrial Advertisers.

Peter Bukoff, formerly an engineer with the Barkley-Grow Aircraft Corp., Detroit, has joined the St. Louis Airplane Division of Curtiss-Wright Corp., as draftsman.

W. W. Angus has established an office as selling agent in Montreal. He was previously sales manager with Collins & Aikman of Canada, Ltd., Toronto.

John C. Squiers is aircraft designer with the Stearman Aircraft Co., Wichita, Kan. He was previously airplane designer with Barkley-Grow Aircraft Corp., Detroit.

Sam Tour, Lucius Pitkin, Inc.; *E. K. Smith,* Electro Metallurgical Co., and *T. A. Boyd,* General Motors Corp., are on the program of the 41st annual meeting of the American Society for Testing Materials, Atlantic City, N. J., June 27-July 1.

Robert I. Dick, formerly assistant chief engineer, Valley Iron Works, Appleton, Wis., has joined the engineering staff of the Witte Engine Works, Kansas City, Mo.

Ronald J. Small is layout draftsman with the Stearman Aircraft Division of Boeing Airplane Co., Wichita, Kansas.

T. V. Buckwalter, vice-president, Timken Roller Bearing Co., and *E. J. Abbott,* president, Physicists Research Co., presented papers at the semi-annual meeting of the American Society of Mechanical Engineers, St. Louis, June 20-23.

S. C. McLaren has been transferred from the Calgary branch to the head office of the Ford Motor Co. of Canada, Ltd., at Windsor, Ont., where he has been placed in charge of truck and commercial car sales. At the Calgary branch he was district sales manager.

Guggenheim Medalist

Cited "for contributions to the development of aircraft engine design and for the specific design of the sleeve-valve aircraft engine," *A. H. R. Fedden* was named Daniel Guggenheim Medalist for 1938, just before presenting his paper on "The Single Sleeve as a Valve Mechanism for the Aircraft Engine" at the Society's Summer Meeting.

Mr. Fedden, who is chief engineer of the Bristol Aeroplane Co. of England, has been a foreign member of the SAE since 1927, and in 1933 was awarded the Society's Manly Memorial Medal. He is an Honorary Fellow of the Institute of the Aeronautical Sciences and a Fellow of the Royal Aeronautical Society.

Other SAE members to receive the Daniel Guggenheim Medal have been *Orville Wright,* in 1929; *Dr. Jerome Clarke Hunsaker,* in 1933, and *Dr. George W. Lewis,* in 1936.

Officers of Guggenheim Fund

Dr. George W. Lewis, director of research, National Advisory Committee for Aeronautics, has been elected president of the Daniel Guggenheim Medal Fund, Inc.; *Elmer A. Sperry, Jr.,* vice-president and chief engineer, Sperry Products, Inc., vice-president, and *Lester D. Gardner,* secretary.

George J. Mead, vice-president and chief engineer, United Aircraft Corp., recently was appointed a member of the Daniel Guggenheim Medal Fund, Inc., and its Board of Award to represent the SAE for a three-year period. Other members representing the Society are Dr. Lewis and C. H. Chatfield.

. . . . At Home and Abroad

Edwin O. Goerke has been advanced from sales engineer to manager of the bearing division of the Bohn Aluminum & Brass Corp., Detroit.

R. N. Janeway, head, dynamics research department, Chrysler Corp., has been named chairman of the publications committee of the Engineering Society of Detroit. *C. C. Gage* of Hudson Motor Car Co. is a member of the committee.

F. C. Horner is one of the official delegates representing the United States at the eighth International Road Congress, The Hague, Netherlands, June 18 to July 2. Mr. Horner, who is assistant to the vice-president, General Motors Corp., is acting chairman of the Highways Committee, Automobile Manufacturers Association.

John P. Reeder, class of '38, University of Michigan, is in Langley Field, Va., as junior engineer with the National Advisory Committee for Aeronautics.

David A. Wallace, president, Chrysler Sales Corp., was a speaker at the annual spring meeting of the Associated Machine Tool Dealers held May 23 and 24 at Dearborn, Mich.

K. T. Keller, president, Chrysler Corp., has been elected first vice-commodore of the recently reorganized Grosse Pointe Yacht Club, Detroit.

Niran Bates Pope, for 20 years managing editor of *Automobile Topics,* has resigned to become associated with the public relations department of the Automobile Manufacturers Association.

Dr. J. C. Geniesse, research engineer, Atlantic Refining Co., was guest of honor at the annual dinner of A.S.T.M. Committee D-2 on Petroleum Products and Lubricants, held in Atlantic City late last month.

Arthur M. G. Moody is joining the De Laval Steam Turbine Co., Trenton, N. J., as engineer in the turbine department. He has been instructor at the University of Delaware, Newark, Del.

Garnet C. Brown has joined the Dow Chemical Co., Midland, Mich. He is in the sales department doing sales and development engineering work.

Dr. Felix L. Yerzley is chairman of a recently organized committee dealing with problems involved in the production and utilization of rubber and plastics, sponsored by the process industries division of the American Society of Mechanical Engineers. Dr. Yerzley is in the organic chemicals department, rubber chemicals division, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

Charles B. Bohn, president, Bohn Aluminum & Brass Corp., and *Irving B. Babcock,* president, Yellow Truck & Coach Manufacturing Co., have been elected directors of Eldorado Gold Mines, Ltd. The organization is developing the silver-radium deposits in mines located on Great Bear Lake, 1140 air miles north of Edmonton, Alberta, Can.

Robert B. Schenck, chief metallurgist, Buick Motor Division of GMC, recently was elected chairman of the Saginaw Valley group of the American Society for Metals.

Tex S. Lines is now design draftsman with the Curtiss Airplane Division of the Curtiss-Wright Corp., Buffalo. He was formerly detail draftsman, Hudson Motor Car Co., Detroit.

F. W. Heckert is vice-president, sales and service manager of the recently organized Curtis Pump Co., Dayton, Ohio, designers and manufacturers of positive rotary-type pumps. Mr. Heckert was formerly sales and service manager of the Romec Pump Co., Elyria, Ohio.

Harold H. Barnes, formerly with the Romec Pump Co., Elyria, Ohio, is head of tool control with the Northrop Div. of Douglas Aircraft Co., Inc., Inglewood, Calif.

Edward P. Warner received the honorary degree of Doctor of Science at the 119th commencement of Norwich University on June 6.

E. P. Warner
Honored

Mr. Warner is now in Los Angeles where he will stay for several months in connection with the flight testing of the DC-4.

H. S. Vance, chairman of the board, Studebaker Corp., and *A. G. Herreshoff,* chief engineer, research, Chrysler Corp., have been named to a liaison committee of the Automobile Manufacturers Association, to cooperate with a similar group in the American Association of Motor Vehicle Administrators. Mr. Herreshoff is chairman of the SAE Engineering Relations Committee.

Ralph H. Houghton is with the Bendix Home Appliance Co., South Bend, Ind., as assistant to the superintendent of time study and layout.

J. Robert Lyon, class of '38, Iowa State College, has joined the National Refining Co., Dubuque, Iowa, as lubrication engineer.

Howard D. Hertz is employed by the Iowa State Highway Commission at Ames, Iowa, as a laboratory assistant in the material testing laboratories. He was formerly production engineer with Refining Industries, Inc., of Portland, Ore.

Hollister Moore, assistant editor of the SAE JOURNAL, has been elected to the executive committee of the New York Business Paper Editors.

William Fenney, Jr., who has been attending Yale University as a graduate student, recently joined the Texas Co. at Beacon, N. Y., as mechanical engineer in automotive research. While attending the university he was employed by the Texas Co. during the summers of 1936 and 1937.

Chester S. Ricker, technical counsel, Detroit office, McCann-Erickson, Inc., celebrated his silver anniversary as director of timing and scoring of the 500-mile Indianapolis race at this year's Memorial Day event. He has served as an official at every 500-mile race.

On Award Committee

SAE members, Dr. George W. Lewis, William B. Mayo, Leighton W. Rogers, Edward P. Warner and T. P. Wright, are among those appointed to membership on the award committee which will select the recipient of the Collier Trophy for 1938, according to the National Aeronautic Association. Award of this 26-year old trophy marks the greatest achievement in aviation during the year for which it is presented.

A. E. M. Sadee, manager, commercial car division, General Motors Continental, S.A., Antwerp, Belgium, is representing the SAE at the meeting of Committee 22 on Automobiles of the International Standards Association, being held in Berlin, Germany, June 30-July 2.

Zsigmond Hollós, designer of military equipment, has opened an office in Paris, France.

Paul N. Fox, who has been an inspector for the Wright Aeronautical Corp., Paterson, N. J., is in China as engineer for the Central Aircraft Manufacturing Co. His headquarters are in Hongkong.

Charles E. Bodey, Jr., is experimental engineer for the Edward E. Johnson Co., St. Paul, manufacturers of welded screen. He was formerly a student at the University of Minnesota.

S. S. Tresilian has left the design department of Lagonda Motors, Staines, England, and is now employed by the Templewood Engineering Co., Ltd., Bucks, England.

Changes at Bendix

Malcolm P. Ferguson, vice-president of Eclipse Machine Co., has been named vice-president and general manager of Bendix Products Corp. *Victor W. Kliesrath,* formerly vice-president in charge of engineering and general manager of Bendix Products, is directing activities of a new marine development division of Bendix Aviation Corp., of which he is vice-president and a director. *Herbert L. Sharlock,* vice-president and director of publicity of Bendix Products, has been made Bendix Aviation Corp. director of public relations.

Judd W. Spray

Judd W. Spray, executive vice-president of the Bower Roller Bearing Co., Detroit, died on April 25. He had been a member of the Society since 1921.

Shortly after finishing school Mr. Judd started with the Diamond Chain & Manufacturing Co., becoming familiar with all steps in the fabricating of block and roller chains for automobile, bicycle and machinery use, before joining the sales staff. In 1916 he joined the Timken Roller Bearing Co., selling to the automotive industry. He was later advanced to general sales manager and in 1929 was named vice-president.

In 1935 he went to Bower Roller Bearing Co., taking the position he held at the time of his death. Mr. Spray was born in Garden City, Kan., in 1886.

Paul B. Rogers

Paul B. Rogers, eastern procurement representative of the Douglas Aircraft Co., died May 23 in Cleveland. He was 41 years old.

Mr. Rogers started his career with the Glenn L. Martin Co., in 1920. He began as a draftsman and was advanced to chief designer, wing and tale surface department. When the Martin factory was moved from Cleveland to Baltimore, in 1929, Mr. Rogers became associated with the Great Lakes Aircraft Corp., as assistant chief engineer. He was made chief engineer in 1930 and was promoted to vice-president in 1934. Last summer he resigned to join the Douglas company. He became a member of the Society in 1929.

News of the Society

(*Continued from page 32*)

program with a talk which placed his listeners in the pilot's seat for a flight from Portland to Salt Lake City. His realistic description left no doubt but that pilots have plenty to do in handling a transport plane.

At Corvallis

Several engineering societies on the Oregon State campus were represented at the Engineers' Day Dinner, May 14, at which prizes were awarded to winners of student paper contests sponsored by local sections of the SAE, the American Society of Mechanical Engineers and the American Society for Metals.

John H. Boner and Lloyd M. Landwehr were joint authors of the paper "General Discussion and Performance Test of the Hesselman Engine," which was selected as best in the SAE contest. Second prize went to Britt M. Smith for his work entitled "A Photo-Elastic Determination of Stress Distribution in Thick-Walled Cylinders." Allan D. McLean's paper, "Performance of a Model 'A' Ford Motor Equipped with Various Cylinder Heads and Carburetors," was awarded third prize. Fourth prize was won by Howard W. Christenson, author of "Development of a Testing Machine and Method for Testing Modern Automobile Brake Linings."

Cash awards of $25, $15 and $10 plus an extra prize consisting of a car heater and defroster were presented to the winners on behalf of the Section by Chairman-Elect J. Verne Savage.

Ideas in Zinc

In these days of fine automobiles and assured performance regardless of price, many sales are made on the basis of details of finish and execution of interior treatment. The discriminating buyer casts his vote for the car that emphasizes comfort and distinctiveness.

As an example of what is being done in this direction, consider the instrument panel of the 1938 Packard. Always noted for the quiet dignity of its luxurious interiors, Packard achieved a new theme by the adoption of zinc alloy die cast sections attractively disposed on the face of the panel.

An examination of this panel will reveal that, although it consists essentially of a sheet metal stamping, the panel proper has been carefully fitted with a number of segments of plated and lacquered zinc alloy die castings. These castings include the two parallel horizontal moldings as well as the handsomely fashioned decorative plate for the ash receiver. Ash trays this year are of generous size for utility, and this plate serves both the practical purpose of supporting the tray and the design function of masking what might otherwise be a distracting detail.

Complementing this ensemble is the balanced treatment of control knobs, compartment knobs, windshield control knob, etc.—die cast and finished in lustrous chromium plate. All in all, Packard has achieved a happy combination of eye appeal and production economy through the versatility of the die casting process. Designers can profit by the availability of the high strength, stable Zamak alloys, based on Horse Head Special ZINC of 99.99+% purity. The New Jersey Zinc Company, 160 Front Street, New York City.

Idea No. 14

Urges Improvement in Human Relationships

● Canadian

"Do more of what people like and less of what they don't like," H. G. Weaver, director of General Motors' customer research, told 182 members and guests at the Canadian Section's Oshawa meeting, May 20.

Introduced by C. E. McTavish, general sales manager, G.M. of Canada, Mr. Weaver declared that the biggest job to be done in commerce, industry and politics, is that of improving human relationships, and this, he said, must be based on betterment of human understanding. "Wisdom," he stated, "must be enhanced by knowledge; it is far from being an inevitable product of it."

Prior to the meeting members participated in an informal golf tournament and visited the Oshawa plants of General Motors of Canada.

Golf Tournament Marks Close of Section Year

● So. New England

The Annual Spring Meeting of the Southern New England Section took place again this year at Shuttle Meadow Country Club at New Britain on June 3.

The entire meeting was given over to matters of a social nature. A golf tournament was held during the afternoon and 25 members competed. Rex B. Beisel won the first prize; Fred Mesinger, second prize and Chester R. Wells, third prize.

In the evening a splendid dinner was enjoyed by 40 members. It was enlivened by entertainment featuring a remarkable female ventriloquist, supplemented by a prodigious manufacturer of assorted aircraft and boomerangs, who turned the material out at an amazing speed and kept the air filled with samples of his art.

This meeting concluded the activities of the Southern New England Section for this season.

Many Subjects Covered At Question-Box Session

● No. California

Heat is the fundamental cause of stuck piston rings. . . . Hydraulic and mechanical brakes are equally efficient. . . . If Diesel fuels are kept clean, maintenance of Diesel engines is approximately the same as of gasoline engines. These are a few of the answers at the Northern California Section's Questions and Answers Meeting held June 14.

Other answers were that: vapor lock is the result of high temperatures in the fuel line and any method of keeping these temperatures at a minimum will help prevent its occurrence; it costs from 3½ to 5 cents per mile to operate fleets of the three low-priced cars; oil smoke and aldehydes formed b · partially burned gases cause exhaust fumes, and safety can be impressed upon truck drivers by educational programs, driving tests and rewards for safe driving practices.

Sidney B. Shaw, Pacific Gas & Electric Co., presided during the question and answer period.

SAE *Coming* EVENTS

Truck, Bus and Railcar Meeting
Chicago – In the fall

Fuels & Lubricants Meeting
Oct. 6-7 Tulsa, Okla.

National Aircraft Production Meeting
Oct. 13-15 Los Angeles
Ambassador Hotel

West Coast Transportation and Maintenance Meeting
Nov. 3-4 Los Angeles

Annual Dinner
Nov. 14 New York City
Commodore Hotel

National Transportation Engineering Meeting
Nov. 14-16 New York City

Annual Meeting
Jan. 9-13, 1939 Detroit, Mich.

Council Acts to Pro-Rate New Members' Dues

Final action approving amendment of paragraph B-14 of the Society's By-Laws took place at the Council's June 14 meeting at White Sulphur Springs. The amended paragraph, which provides for quarterly pro-rating of new members' first year's dues, reads as follows:

B-14 The initiation fees and current dues shall be due and payable on notice of election to membership, and upon payment the member shall be entitled to the Society's publications for the period. Current dues for members elected in the first quarter of the fiscal year shall be a full year's annual dues; in the second quarter of the fiscal year shall be three-fourths of the annual dues; in the third quarter shall be one-half of the annual dues; and in the fourth quarter shall be one-fourth of the annual dues. Thereafter the annual dues shall be due and payable on the first day of October in each year.

Applications Received

(*Continued from page 43*)

Northwest Section

BROWN, WALLACE M., draftsman, Kenworth Motor Truck Corp., Seattle, Wash.

CZARNIECKI, JOHN, engineer, Kenworth Motor Truck Corp., Seattle.

PENNELL, DONALD E., sales engineer, Kenworth Motor Truck Corp., Seattle.

Philadelphia Section

GRISWOLD, FRANK TRACY, treasurer, Griswold-Wilson, Inc., Ardmore, Pa.

VAN HARTESVELDT, C. H., assistant supervisor, automotive laboratory, Atlantic Refining Co., Philadelphia.

Southern California Section

RACHAL, CLIFTON, draftsman, Douglas Aircraft Co., Santa Monica.

WITHROW, ARTHUR C., owner, Arthur C. Withrow Co., Los Angeles.

St. Louis Section

DREHER, HEDLEY R., chief engineer, The Bondall Co., St. Louis, Mo.

PARRISH, GEORGE IMBODEN, secretary and treasurer, Bondall Co., St. Louis, Mo.

Washington Section

AMERICAN TRUCKING ASSOCIATIONS, INC., Washington, D. C.

HARMAN, J. W., president, Harman-Loving, Inc., Richmond, Va.

LACY, GEORGE B., truck sales, truck lease, Parkway Motor Co., Inc., Washington, D. C.

Outside Section Territory

EELLS, DON V., superintendent (refinery) Cities Service Oil Co., Okmulgee, Okla.

GUIBERSON, ALLEN, vice-president, Guiberson Corp., Dallas, Texas.

HESS, ALVA, manager, Hess Auto Repair, Buckhannon, West Va.

PARKER, JAMES HODGES, inspector, Virginia Electric & Power Co., Suffolk, Va.

WATSON, JAY R., manager, Atlas Imperial Diesel Engine Co., Mattoon, Ill.

Foreign

LAMBERT, C. A., general manager, Pechelbronn-Antar, Paris, France.

NEWTON, JOHN WOOD, managing director, Enwood Steel Products, Ltd., Queen St., Nottingham, England.

ORNSTEIN, WILHELM, engineer of technical division, Lilpop, Rau and Locwenstein, Warsaw, Poland.

SCHLUMBERGER, R. A., co-manager, Pechelbronn S.A.E.M., Strasbourg, France.

University of Alabama

(*Continued from page 31*)

completed and instruction was resumed.

Engineering courses were added to the curriculum in 1837, and in 1909 the College of Engineering was established as a separate division of the University. At that time it embraced the departments of civil, mechanical, electrical and mining engineering. Aeronautical engineering was added in 1927.

The University's new engineering building was completed in 1936, housing, among other things, the heat engine and aeronautics laboratories. At about the same time two buildings were added to the group of the Southern Station of the United States Bureau of Mines, which is located on the campus.

Recently the Chrysler Corp. presented the University with a complete set of illustrated lectures and a demonstration model of a Dodge chassis. This has proved to be of great interest to Student Branch members and the student body as a whole.

Methods of Determining Vapor Lock Discussed

● **Tulsa Group**

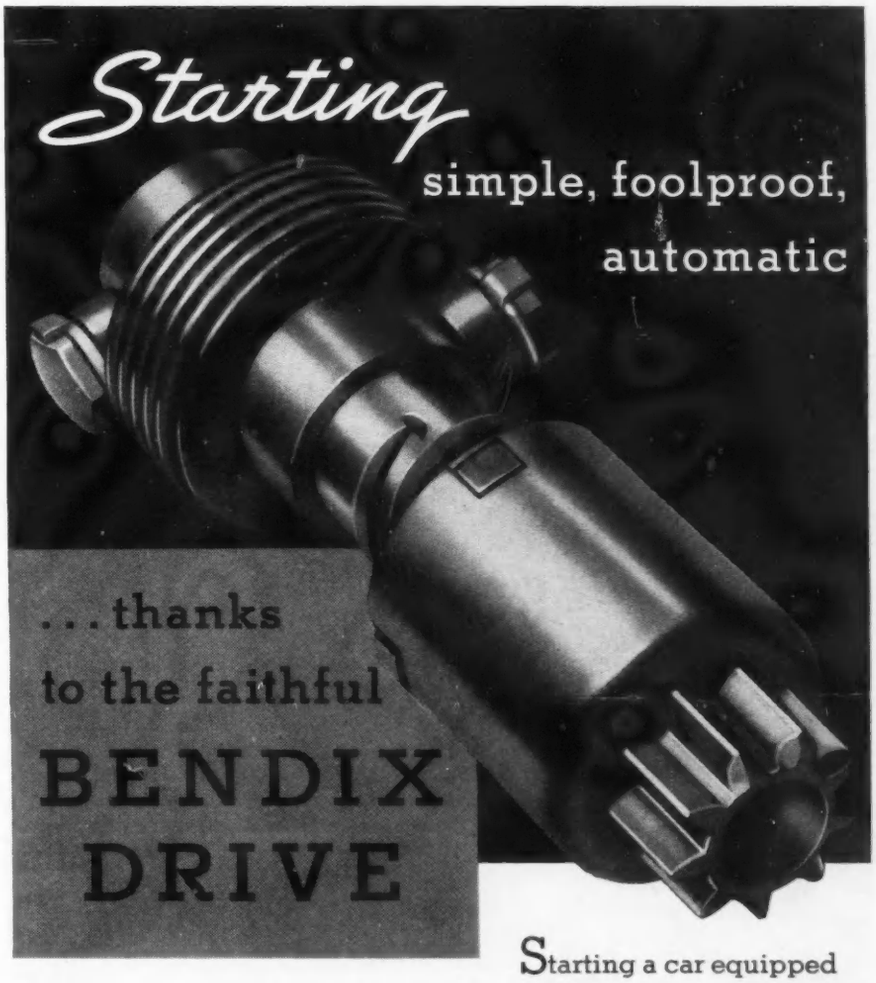
B. E. Sibley, chief technologist, Continental Oil Co., explained the methods to be used by the American Petroleum Institute and Co-operative Fuel Research joint committees for 1938 in determining the road octane requirements of 1937 and 1938 models of three low-priced cars, and the approved method of determining vapor-lock characteristics of the same cars, at the June 3 meeting of the Tulsa Group. The methods discussed by Mr. Sibley were those approved at the recent A.P.I. convention held in Wichita, Kan.

R. R. Couch, Phillips Petroleum Co., gave a brief discussion of the Pawhuska vapor-lock road tests. This was followed by motion pictures of the tests shown through the courtesy of its sponsors, the National Gasoline Association and the Western Petroleum Refiners' Association.

Dancing Feature of Ladies' Night Program

● **Milwaukee**

The Milwaukee Section held its annual Ladies' Night Dinner-Dance at the Wisconsin Club on June 3. After dinner the film, "Steel—Man's Servant," loaned to the Section by the Carnegie-Illinois Steel Corp., was shown. From then on dancing was the order of the evening.



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The Bendix Drive keeps faith with the driver all the time. And motorists know it. Thus, they prefer the car that's Bendix-equipped.

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(Subsidiary of Bendix Aviation Corporation)

SAE Student Branches Elect New Officers

SAE Student Branches at University of Michigan, New York University and University of Oklahoma have elected officers for the ensuing school year.

At Michigan Fitz J. Bridges was elected chairman; C. M. MacKichan, program chairman, and Foster R. Gaylord, chairman of the membership committee. Other officers will be elected in the fall.

The N.Y.U. Student Branch elected Richard Berne, chairman; T. Courtenay Wakefield, vice-chairman, and Heighton D. James, secretary-treasurer.

Silas E. Gassett is the new chairman of the University of Oklahoma Branch. Other officers are B. E. Christensen, vice-chairman, and John Riley, secretary-treasurer.

Oil Soaks SAE Members As New Well Comes In

● Buffalo

Several Buffalo Section members were drenched with good Pennsylvania crude while watching a new well come in during an inspection trip through the producing grounds, refinery and laboratories of the Kendall Refining Co., at Bradford, Pa.

The Kendall organization arranged the program, providing ten guides to conduct the 45 visiting SAE members on the tour. After a morning in the oil fields, time was taken out for luncheon before visiting the refinery and laboratories.

Manufacturer Controls Temperature
LONG AFTER THE SALE IS MADE
● Dole Thermostats for motor temperature control are typical of the many devices by which a positive automatic response to heat and cold can be pre-determined. The manufacturer's interest in his motor, for example, does not end with good performance on the testing block. He wants to assure good performance under all conditions, thereby increasing his reputation and his sales. A thermostat in the block promises this . . . and a Dole Thermostat, as a majority of automotive manufacturers have learned, will deliver most dependably.
Engineers are using Dole Thermostatic Bi-Metal in devices of their own development for automatic temperature response. We furnish it in sheets, fabricated parts ready for assembly, or we complete the device, as desired. Our engineering and manufacturing departments are available to assist you. Write us.
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Thermostats
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About Authors

(Continued from page 15)

● **G. T. Lampton** *(M '38), was commissioned in the Air Corps immediately upon graduation from the University of California in 1923. During his six years of military service he was graduated from the Air Corps Flying School with the rating of airplane pilot and airplane observer. He was graduated also from the Air Corps Engineering School and the Chemical Warfare School. The remainder of his service was in the propeller unit of the Materiel Division. He resigned from the Air Corps in 1929 to engage in the successful development of a seamless hollow-steel propeller blade. For the past several years he has been responsible for the design of the Lycoming-Sm'th controllable propeller and he is now engineering manager of the propeller division of the Aviation Manufacturing Corp., Lycoming Division.*

● **John Ryle MacGregor** *(M '29), is an alumnus of the University of California, class of '23. After receiving his B. S. in mechanical engineering he attended the U. S. Flying School at Brooks Field, Tex., for one year, and then served as engineering officer, 316th Squadron, U. S. Army Air Service, until joining the research and development department of the Standard Oil Co. of Calif. in 1925. He started with that company as a fuel and lubricant test operator, and was steadily advanced until reaching his present position as fuel specialist. He is active on a number of SAE administrative and technical committees.*

● **H. O. Mathews** *(M '31), is an alumnus of Purdue University, receiving his B.S.E.E. degree in 1923 and the professional degree of Electrical Engineer in 1927. Starting with the Bell Telephone System in 1923 he served in various capacities in the plant department until December 1930. At that time he took charge of the automotive department in Chicago, with the operation and maintenance of 500 trucks under his supervision. He continued in that capacity until December 1936 when he joined the Public Utility Engineering and Service Corp. as automotive engineer.*

● **G. A. Round** *(M '17), received his B. S. from Brown University with the class of '10. His first job was in the traffic engineering department of A. T. & T. After a year he resigned to work with the late A. F. Masury in the Hewitt Motor Co., one of the original units of Mack-International. Since 1914 he has been connected with the Vacuum Oil Co. and Socony-Vacuum Oil Co. as automotive engineer. Mr. Round is a past-chairman of the SAE Metropolitan Section and a member of several national committees of the Society.*

● **A. S. Van Halteren** *(M '17), after receiving his B.S. degree from Michigan State in 1907 joined the Seager Engine Works of Lansing, Mich. The company sent him to Cairo, Egypt, in 1911 to represent them on plowing tractors and irrigation equipment. After three years he returned to the United States and joined the Reo Motor Car Co.'s service department. In 1915 he affiliated with the Motor Wheel Corp. as chief engineer; continuing in that capacity until when he became development engineer for the company.*

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GASOLINE GAUGES
GASOLINE STRAINERS
INSTRUMENT PANELS
ENGINE BEARINGS
LOCKER DOORS
OIL FILTERS
PRESSURE GAUGES
RADIATOR PRESSURE CAPS
REFLEX SIGNALS
REMO INJECTORS AND FLUID
SPARK PLUGS
SPARK PLUG CLEANERS
SPARK PLUG TESTERS
SPARK PLUG GAPPING TOOLS
SPEEDOMETERS
TACHOMETERS
THERMO GAUGES
VACUUM PUMPS

(*Concluded from page 42*)

Tabular data are presented by the author, giving the specifications for lubricants used as initial filling at the factory.

Mr. Geschelin notes that the present trend to passenger-car hypoid rear axles and the development of highly acceptable active extreme-pressure lubricants for this service, has brought about a new and vexing service problem, as service stations attempt to use the powerful or active materials in heavy-duty axles and transmissions. This is so serious, he adds, that a number of manufacturers have issued bulletins to dealers and users prohibiting the use of any hypoid-gear lubricants in heavy-duty units of their make.

Discussion

Mr. Sparrow's paper shows the direction both the automotive and the oil industries must go to produce engines and lubricants which will be most satisfactory in the hands of the car owner from a lubrication point of view, H. R. Wolf, Research Laboratories Division of General Motors Corp., declared in opening the discussion.

Dr. C. M. Larson of Sinclair gave figures to show that 10 years ago oil consumption averaged about 100 miles per qt., at high speed. Now, he said, it is not unusual for a heavy-duty truck to travel 2000 or more miles between drains, and consume barely half a pint of oil.

Dr. Larson also noted that blow-by is increasing with lower viscosity oils and that the sludge problem is getting beyond control. Likewise, he said, dilution today is back to where it was when we used 440 end point gasoline, adding that he would not be surprised but that we will get back to 30 oil.

G. L. Neely, Standard Oil Co. of Calif., observed that Mr. Sparrow's paper pointed out that the use of high viscosity oils in engines is attended by many disadvantages, including the important one of increasing gasoline consumption. On the other hand, he said, the author pointed out that light oils increase the problem of breaking in new engines, and presented data which show viscosity of oil for breaking in is closely related to the degree of roughness of the surfaces; rough surfaces requiring heavier oil and smooth surfaces, lighter oil.

Thus, Mr. Neely noted, the usual concept of breaking-in oil viscosity is somewhat out of keeping with Mr. Sparrow's conclusion, in that it has been common practice to use light oils for breaking in an engine and to use heavier oils as needed for consumption purposes; whereas Mr. Sparrow's data indicate that light oils are satisfactory provided adequate surfacing has been accomplished by breaking in with heavy oils.

There is a possibility, Mr. Neely said, that a definition of breaking-in oil required in the future may include a joint statement of the surface to be broken in.

Answering a question by A. Ludlow Clayden, Sun Oil Co., as to the advantages of additive agents in permitting use of lower viscosity oils, Mr. Sparrow told of a test in which 5 per cent of kerosene was added to 10-W oil. When a sperm oil additive was used, he reported, there was no scuffing, but there was without the additive.

"The nut that holds the steering wheel" received considerable attention in the discussion of Mr. Geschelin's paper. Mental limitations of the driver were pointed out, and it was generally agreed that one of the big jobs facing both the automotive and the oil industry is to make it impossible for the average owner or the man who services his car to damage the vehicle by using improper lubricants.

One method suggested was the development of safe lubricants to take the place of those which are not safe when used where they shouldn't be. H. R. Wolf, in prepared discussion, stated that a single gear lubricant, capable of satisfactorily lubricating hypoid gears under the most severe service conditions, and sufficiently stable and free from objectionable properties when used in mechanisms that do not require the maximum in load carrying properties, would eliminate the confusion that now exists in the field and would reduce the stocks that have to be carried by petroleum refiners. Other discussers told of steps in this direction taken by some of the oil companies.

George A. Round, Socony Vacuum Oil Co., called attention to the fact that today practically all service stations are leased, and that the oil companies have little control over their stocks or personnel. The most they can do, he said, is to make recommendations and hope that they will be followed. He wholeheartedly agrees with a statement made by Mr. Wolf that car manufacturers and oil companies must simplify lubrication recommendations.

W. S. James, Studebaker Corp., brought out the point that the car engineer does not know what lubricants are available in filling stations. He feels that if the oil companies would keep the automotive engineers advised as to what is now available in filling stations, and what will be available next year, then the car companies would better keep their recommendations within that range. As it is, he said, the engineers are somewhat in the dark.

Another discusser pointed out that automotive engineers recommend one type lubricant because they know that it will keep them out of trouble – not because they know that something else will get them into trouble. He added that automotive engineers are just as eager to keep the number of lubricants to a minimum as the oil companies are.

Among those entering into the discussion of these papers, not specifically mentioned above, were W. G. Clark, Pure Oil Co.; Austin M. Wolf, automotive consultant; S. O. White, Warner Gear Division, Borg-Warner Corp.; George H. Freyermuth, Standard Oil Co. of N. J., and E. W. Upham, Chrysler Corp.

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